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FLIGHT TEST MEASUREMENT OF VERTICAL  
AND HORIZONTAL TAIL LOADS DURING  
RUDDER KICK AND STEADY SIDESLIP  
MANEUVERS

D. W. Rhoads

Prepared by  
Cornell Aeronautical Laboratory, Inc.  
Buffalo, New York

United States Air Force  
Air Research and Development Command  
Wright Air Development Center  
Wright-Patterson Air Force Base, Dayton, Ohio

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### ABSTRACT

The vertical and horizontal loads sustained during rudder kick and steady sideslip maneuvers have been investigated by means of flight tests conducted on an F-80A airplane by the Flight Research Department of the Cornell Aeronautical Laboratory, Inc., Buffalo, New York. The length of time the maximum rudder deflection is held has been shown to have a critical influence on the vertical tail load. Tests show that the most critical condition is reached if the rudder angle is forced to return to zero deflection from its maximum value at the time maximum heading change (~~or zero yaw rate~~) is attained.

The dissymmetry of the horizontal tail loads due to steady sideslip is illustrated by steady sideslip tests conducted for this purpose.

### PUBLICATION REVIEW

Manuscript Copy of this report has been reviewed and found satisfactory for publication.

FOR THE COMMANDING GENERAL:

JACK A. GIBBS  
Colonel, USAF  
Chief, Aircraft Laboratory  
Engineering Division

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## SYMBOLS, DEFINITIONS AND CONVENTIONS

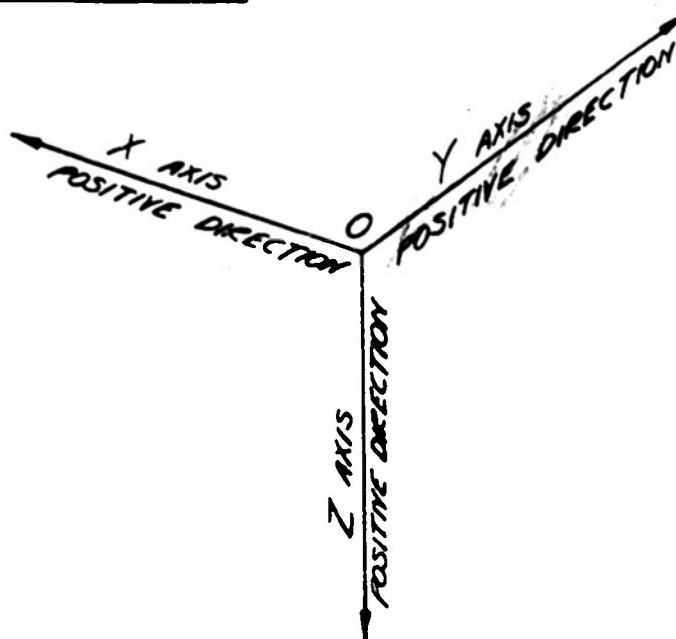
### Axes

Stability axes are used throughout this report. These mutually perpendicular axes are fixed to the airplane and, therefore, move with it during a maneuver. Their origin O lies at the center of gravity of the airplane. OX and OY lie in the plane of symmetry and OZ is perpendicular to it. These axes are fixed to the airplane by subjecting OX to the condition that it be parallel to the free stream wind vector in initial trimmed level flight.

X Axis, or longitudinal axis is positive forward.

Y Axis, or transverse axis is positive along the right wing.

Z Axis, or normal axis is positive downward.



<u>MEASURED DATA</u>	<u>SYMBOL</u>	<u>POSITIVE DIRECTION</u>
1. Elevator Angle	$\delta_e$	1. Trailing edge of elevator down.
2. Rudder Angle	$\delta_r$ or $\delta_R$	2. Trailing edge of rudder to the left as you are looking along the positive X axis.
3. Total aileron angle	$\delta_a$	3. Trailing edge of right aileron down (left wing down).
4. Normal acceleration	$n_z$	4. Acceleration of c.g. of the airplane in a downward direction (pilot is pushed against belt).
5. Right stabilizer bending moment	RBM	5. Moment due to load applied to a downward direction.
6. Left stabilizer bending moment	LBM	6. Moment due to load applied in a downward direction.
7. Right stabilizer shear	RS	7. Load applied in a downward direction.
8. Sideslip angle	$\beta$	8. Displacement along the y axis toward the right (nose to the left of relative wind).
9. Left stabilizer shear	LS	9. Load applied in a downward direction.
10. Fin bending moment	FBM	10. Moment due to load applied to the right looking along the positive X axis.
11. Fin shear	FS	11. Load applied to the right looking along positive X axis.
12. Rate of yaw	$\dot{\psi}$	12. Angular velocity about the Z axis (clockwise when looking along + Z axis) (Nose to the right; right wing back).
13. Rate of roll	$\dot{\phi}$	13. Angular velocity about the X axis to the right (right wing down).

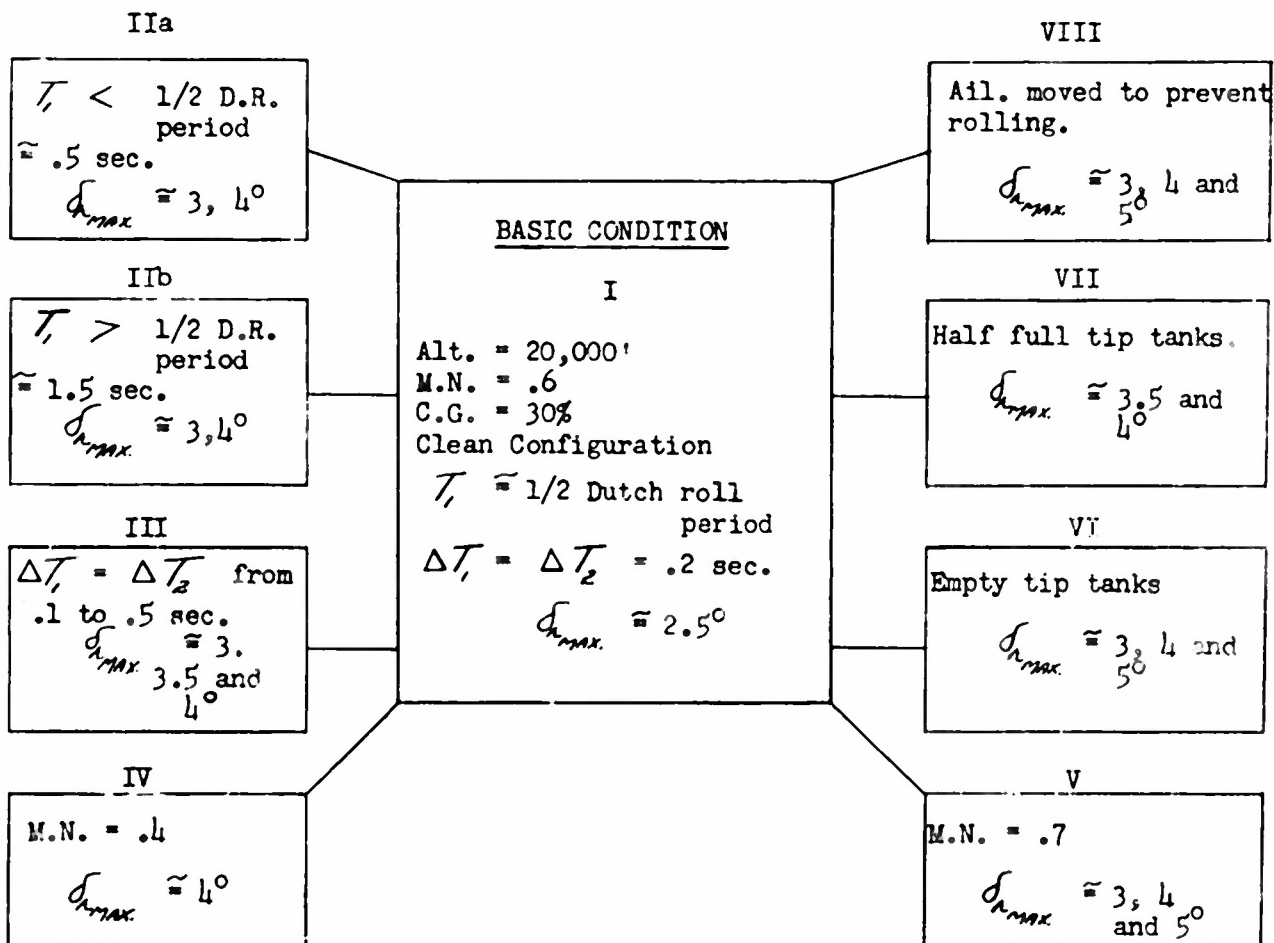
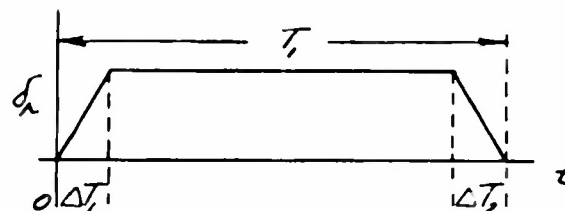
## INTRODUCTION

As a continuation of the dynamic stability and tail load study of the F-80A airplane, under Air Force Contract No. W33-038-ac-18517 (18480), this report presents the results of a series of rudder kick and sideslip flight tests in accordance with Change Order Number 13 of the above contract.

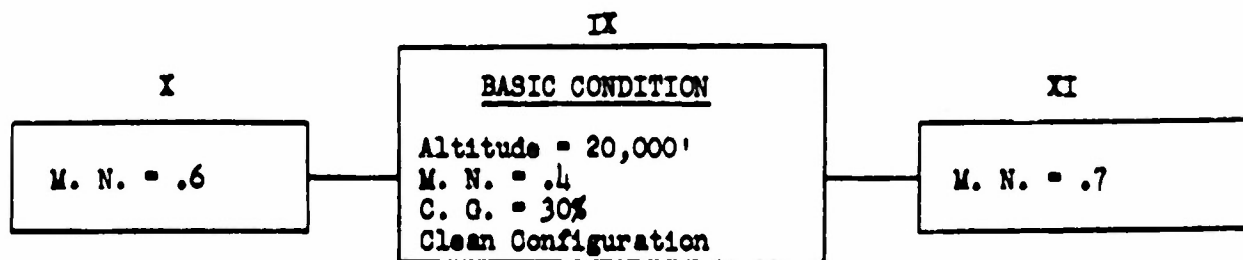
The primary objective of the rudder kick portion of the program was to determine the rudder deflection time history which would produce the most critical vertical tail loads, as well as to observe the relationship between the vertical tail load and the magnitudes of sideslip and rudder deflection applied. The tests were done at an altitude of 20,000' under several geometric and aerodynamic configurations, as noted below.

The purpose of the steady sideslip tests was to obtain data on the dissymmetry of the horizontal tail loads for future analysis. These tests were run at three different Mach numbers. A flight program block diagram appears below.

### I. Rudder Kick



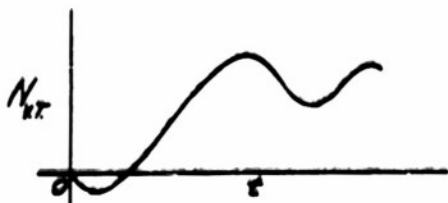
## II. Steady Sideslip



The branches represent changes from the basic condition as indicated by the quantities in the branch boxes. A total of 26 rudder kick and 3 steady sideslip conditions is presented.

### Theory

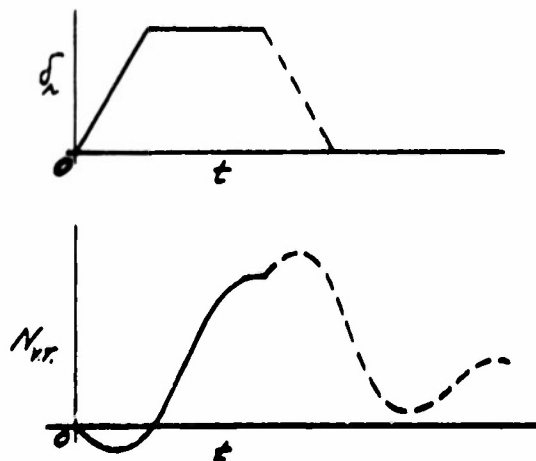
The assumption that the rudder kick maneuver may be critical from a vertical tail load standpoint may be illustrated in the following manner. If the rudder input is a step or the beginning of a ramp, the quantitative vertical tail response is:



Where  $N_{K_T} = f(\beta, \dot{\beta}, \dot{\alpha}, \delta_r)$

The rudder effectiveness contribution,  $\left(\frac{\partial N_{K_T}}{\partial \delta_r} \delta_r\right)$  is important for it

tends to, in the above case, reduce the tail load as indicated by the portion of the curve below the origin. If, however, the rudder is returned to its neutral position, in effect, a "reverse" step or partial ramp is produced as indicated below.



It may be seen that depending upon the timing of the return input (the combination with the initial input has now produced a full ramp input) the rudder effectiveness portion of the vertical tail load function is now added to that produced by the initial rudder motion. If rudder deflection magnitudes are excessive, the additional increment of tail load caused by the rudder effectiveness portion due to the return motion may produce a critical tail load.

F-80A vertical tail load flight test data obtained during previous programs was used to predict maximum vertical tail load during both the rudder kick and steady sideslip maneuver, thereby insuring the safety of pilot and test vehicle.

In addition to the basic load quantities recorded, control deflections, rotational velocities, normal acceleration and bending moments are presented as time histories.

## EQUIPMENT AND METHODS

### Equipment

The test vehicle used for these measurements was a Lockheed F-80A-TALO fighter type aircraft. This is a low wing, single place, jet propelled airplane powered by an Allison J-33-11 engine. Dimensions and leading particulars are on pages 10 through 12. A photograph and three view drawing are shown on pages 13 and 14.

Flight test data were recorded by a photo-observer and a fourteen channel Consolidated Engineering Corporation recording oscillograph.

The following items were recorded on the oscillograph:

1. Aileron Position
2. Elevator Position
3. Rudder Position
4. Normal Acceleration
5. Fin Shear
6. Fin Bending Moment
7. Sideslip Angle
8. Rolling Velocity
9. Yawing Velocity
10. Right Stabilizer Shear
11. Right Stabilizer Bending Moment
12. Left Stabilizer Shear
13. Left Stabilizer Bending Moment

Stabilizer shear and bending moment were measured at Station 10" from the stabilizer centerline. Fin shear and bending moment were measured at water line 129" from the reference centerline. Aileron, elevator, and rudder position were measured at the point where the control surfaces attach to the control system; that is, at the elevator and rudder horns and the aileron quadrants.

The following items were recorded on the photo-observer by a 35mm movie camera:

1. Airspeed (Ship's system and Prandtl tube)
2. Altitude
3. Outside Air Temperature
4. Fuel Quantity Remaining
5. Run Number (Oscillograph)
6. Frame Number (Camera)
7. Bank Angle
8. Stop Watch

For details of the recording instrumentation design procedures for calibration, and an estimate of overall recording accuracy, the reader is referred to Reference (1). The development of instrumentation for the purpose of measuring total tail loads and recording the data on a single oscillograph trace is presented in Reference (2). Details of instrumentation component types and models are recorded in Reference (3).

## Methods

The condition imposed whereby the rudder kick duration is approximately one-half the Dutch roll period was designed to superimpose the return portion of the vertical tail load response on the peak of the load caused by the initial disturbance, thereby illustrating the maneuver characteristics which could cause a critical load condition. Previous flight has shown that, in response to a rudder step input, maximum sideslip angle and, hence, vertical tail load occurs at approximately zero yaw rate, which in turn approximates maximum heading angle. This latter quantity could be visualized by the pilot with reference to some point on the ground, and therefore used as a criterion for the specified program of kick durations.

Rudder kick maneuvers were performed both to the right and to the left. No particular difference may be noted between the two directions and no effort was made to present the same number of left and right for each condition. However, of the total number of rudder kick maneuvers presented, thirteen are to the left and thirteen are to the right.

Steady sideslips were performed for a number of rudder deflection magnitudes, ranging from approximately -8 to +8 degrees, resulting in sideslip, load and bending moments as a function of rudder deflection. attempt to maintain zero rolling velocity was made by using sufficient aileron in each case to null the rolling moment due to sideslip velocity.

$\beta_{max} - \left( \frac{d\beta}{dt} = 0 \right) \text{ (approx 4)}$   
 $\dot{\psi}_{VT} \text{ (approx zero yaw rate)}$

## CONCLUSIONS AND RECOMMENDATIONS

Examination of the flight test data obtained as a result of the execution of this flight program has indicated the following:

1. The additional increment of tail load caused by the return of the rudder to its approximate neutral position is a considerable percentage of the load caused by the initial rudder displacement.
2. Whether or not this increment occurs at the maximum load due to the initial rudder disturbance depends on the rudder "holding time".
3. If the above does occur, the total load on the vertical tail may be critical, depending on the rudder magnitude initially adopted.
4. An extension of this maneuver to a "fishtail" maneuver, or a series of alternating positive and negative ramp inputs, indicates an even more critical condition due to the repeated alternating loads.
5. Sufficient data has been obtained during both the rudder kick and steady sideslip phases of this flight program to provide a fund of information for future analysis of this type of maneuver and to obtain a thorough check of the accuracy of any proposed method of calculation of these loads.

It is recommended that such analyses as noted above be carried out, including extension to more severe rudder kick maneuvers than performed in these flight tests.

# REFERENCES

1. Kelly, D., Skelly, E. and Hirtreiter, W.J. "Instrumentation Of An F-80A Airplane For Dynamic Stability and Tail Load Flight Tests - Part I". Cornell Aeronautical Laboratory Report No. TB-495-F-8.
2. Walter, M.A. "Instrumentation of an F-80A Airplane for Dynamic Stability and Tail Load Flight Tests - Parts II and III". Cornell Aeronautical Laboratory Report No. TB-495-F-8.
3. Rhoads, D.W. "Flight Test Measurement of Vertical and Horizontal Tail Loads During a Rudder Locked Rolling Pullout Maneuver". Cornell Aeronautical Laboratory Report No. TB-541-F-4.  
AFTR 6743

APPENDIX I

# DIMENSIONS AND LEADING PARTICULARS

F-80A Serial No. 44-85333

## I. Principal Dimensions

## Dimensions

### A. Airplane - General

Span	33' 10-1/2"
Length (overall)	31' 6"
Height	11' 4"

### B. Wings

#### Airfoil Section

Root	NACA 65 <sub>1</sub> - 213 ( $\mu = 0.6$ )
Tip	NACA 65 <sub>1</sub> - 213 ( $\mu = 0.6$ )
Chord at Root (at airplane $\frac{1}{4}$ )	109.98"
Chord at Tip (Theoretical) (Tangent to tip)	41.89"
Incidence at Root	+ 1°
Incidence at Tip	-0° 30'
Dihedral - Trailing edge in Wing Ref. Plane	3° 50'
Sweepback (Leading edge)	0° 20'
Rear beam (Straight line) at	62% chord
Aspect Ratio	6.38
Taper Ratio ( $\lambda$ )	.381
Mean Aerodynamic Chord (MAC)	60.8"
Flap and aileron hinge $\frac{1}{4}$ at	76% chord
Leading edge of wing to leading edge of MAC	16.28"

### C. Empennage

#### Horizontal Stabilizer

#### Airfoil Section

NACA 65<sub>1</sub> 2 - 010

Tail length (distance from 3/4 of wing MAC to elevator hinge line)	16.46 ft.
Tail length (distance from 3/4 of wing MAC to 3/4 of tail MAC)	14.74 ft.
Span	15.60 ft.
Incidence to horizontal reference line	1° 30'
Root chord ( $C_R$ )	4.33 ft.
Tip chord ( $C_T$ )	1.503 ft.
Aspect ratio ( $AR$ )	6.56
Taper ratio ( $\lambda$ )	.388
Elevator $E$ - ratio of elevator area to area of horizontal stabilizer (including elevator)	.246
Mean geometric elevator chord: $c_e$	
Elevator area: $S_e$	
$c_e S_e$	7.78 ft. <sup>3</sup>

Trim tab dimensions  
 Spring tab dimensions  
 Elevator hinge center line at

chord -  $3 \frac{7}{16}$ " span - 15.75"  
 chord -  $4 \frac{5}{8}$ " span - 10"  
 75% chord

#### Vertical Stabilizer

Airfoil section

NACA 65<sub>1</sub> - 2 - 010

Height

7.92 ft.

Root chord ( $C_R$ )

5.41 ft.

Tip chord ( $C_T$ )

2.165 ft.

Aspect ratio ( $AR$ )

1.832

Taper ratio ( $\lambda$ )

.4

Rudder chord: ( $c_R$ )

Rudder area: ( $S_R$ )

$c_R S_R$

5.36 ft.<sup>3</sup>

Trim Tab dimensions

chord - .75"

span - 12"

Rudder hinge center line at

75% chord

#### D. Fuselage

Width (max.)

56"

Height (max.)

56"

Plan area

127.97 sq. ft.

Side area

135.86 sq. ft.

Distance from nose to 25% MAC

205.45"

## II. Areas

Sq. Ft.

### A. Wing

Total wing area

237.6

Wing flap area (total)

30.2

Total aileron area aft of hinge line  
 (including tabs)

17.0

Left aileron trim tab area

0.4

### B. Empennage

Total Horizontal tail area

43.6

Stabilizer fixed area to elevator hinge (each)

17.4

Elevator area aft of hinge line (each)  
 (including tabs)

4.35

Elevator trim tabs (each)

.47

Elevator spring tabs (each) -

.09

Total vertical tail area

22.5

Fin area

17.2

Rudder including fixed tab

5.6

### III. Controls Surface Travel

	<u>up</u>	<u>down</u>
Ailerons	20°	20°
Aileron trim tabs (measured at inboard end of tab)	20°	20°
Elevators (measured at junction of inboard elevator rib and elevator tab hinge)	38°	16°
Elevator trim tabs	15°	15°
Tab servo ratio 1:3		
Elevator spring tabs	10°	22°
Wing flaps		45°
Dive recovery flaps		78° 30'
Rudder (measured at bottom of rudder)	30° rt.	30° lt.

### IV. Fuel Tanks Capacities

	<u>U.S. Gals.</u>
Fuselage (1)	207
Wing - Inboard forward (2)	60
Inboard aft (2)	70
Outboard intermediate (2)	22
Outboard (2)	8
Leading edge (2)	58
Tip (droppable) (2)	330
Total internal fuel capacity	425



F-80 A AIRPLANE 3/4 LEFT REAR VIEW

Figure 1  
- 13 -



### F-80A MASS CHARACTERISTICS

The moments of inertia and gross weight of the airplane during these flight tests were approximately the same as for similar geometric configurations of Reference (3). For the tip tank off flights (c.g. at 30% MAC):

$$I_x \approx 7060 \text{ slug ft.}^2$$

$$I_z \approx 18000 \text{ slug ft.}^2$$

$$\text{Gross Weight} \approx 10,500 \text{ lbs.}$$

For the flights with empty tip tanks (same c.g.):

$$I_x \approx 9200 \text{ slug ft.}^2$$

$$I_z \approx 21500 \text{ slug ft.}^2$$

$$\text{Gross Weight} \approx 10,900 \text{ lbs.}$$

For the flights with half full tip tanks (same c.g.):

$$I_x \approx 21800 \text{ slug ft.}^2$$

$$I_z \approx 34500 \text{ slug ft.}^2$$

$$\text{Gross Weight} \approx 11,500 \text{ lbs.}$$

## FLIGHT CONDITIONS

### I. Rudder Kicks

#### Condition I

Alt. = 20,000 ft.

M.N. = .6

C.G. = 30% MAC

Clean Configuration

$T_1 \approx 1/2$  Dutch roll period  $\approx 1$  sec.

$\Delta T_1 = \Delta T_2 = .2$  sec.

$\delta_{n_{MAX}}$  ranges from 2 to 5 degrees

#### Condition IIa

Same as Condition I except  $T_1 < 1/2$  Dutch roll period  $\approx .5$  sec.

$\delta_{n_{MAX}} \approx 3$  and 4 degrees

#### Condition IIb

Same as Condition I except  $T_1 > 1/2$  Dutch roll period  $\approx 1.5$  sec.

$\delta_{n_{MAX}} \approx 3$  and 4 degrees

#### Condition III

Same as Condition I except  $\Delta T_1 = \Delta T_2$  is varied from .1 sec.

to .5 sec.  $\delta_{n_{MAX}} \approx 3, 3.5$  and 4 degrees

#### Condition IV

Same as Condition I except that M.N. = .4  $\delta_{n_{MAX}} \approx 4$  degrees

#### Condition V

Same as Condition I except that M.N. = .7  $\delta_{n_{MAX}} \approx 2, 3,$  and 4 degrees

#### Condition VI

Same as Condition I except empty tip tanks.  $\delta_{n_{MAX}} \approx 3, 3.5$  and 4.5 degrees.

#### Condition VII

Same as Condition I except half full tip tanks.  $\delta_{n_{MAX}} \approx 3.5$  and 4 degrees.

#### Condition VIII

Same as Condition I except ailerons are manually moved to prevent rolling.  $\delta_{n_{MAX}} \approx 3, 4$  and 5 degrees.

### II. Steady Sideslip

Condition IX - Altitude = 20,000 ft.

M.N. = .4

C.G. = 30%

Clean Configuration

Condition X - Same as Condition IX except M.N. = .6

Condition XI - Same as Condition IX except M.N. = .7

# FLIGHT LOG

F-80A RUDDER KICK FLIGHT TEST PROGRAM  
F-80A #44-85333

AFTR-6743

FLT. NO.	DATE 1951	PURPOSE	DATA REQUESTED						DATA OBTAINED										COMMENTS			
			MACH	$\delta_n$	*	$\delta_a$	T	$\Delta T$	$\Delta T_2$	TIP TANKS	RUN	COND.	MACH	$\delta_n$	*	$\delta_a$	T	$\Delta T$		$\Delta T_2$	TIP TANKS	
33	7/20	Cond. I, IIA, IIB, III, IV, V	.4	40	R	Locked	1	.2	.2	.2	Off	9138	IV	.39	-3.80	R	Locked	1.5	.2	.2	Off	Reduced
			.4	40	R	"	1	.2	.2	.2	Off	9139	I	.60	-3.00	R	Locked	1.25	.2	.2	Off	Good run, not read.
			.6	40	R	"	1	.2	.2	.2	Off	9140									Reduced.	
			.6	40	R	"	1	.2	.2	.2	Off	9141									Good run, not read.	
			.6	40	R	"	1.5	.2	.2	.2	Off	9142	IIB	.59	-3.20	R	Locked	1.75	.2	.2	Off	Good run, not read.
			.6	40	R	"	1.5	.2	.2	.2	Off	9143	IIA	.59	-3.00	R	Locked	.75	.2	.2	Off	Reduced
			.6	40	R	"	.5	.2	.2	.2	Off	9144									Reduced	
			.6	40	R	"	.5	.2	.2	.2	Off	9145									Good run, not read.	
			.6	40	R	"	1	.1	.1	.1	Off	9146	III	.59	-3.60	R	Locked	1.00	.1	.1	Off	Good run, not read.
			.6	40	R	"	1	.1	.1	.1	Off	9147	III				Locked	1.50	.3	.35	Off	Reduced
			.6	40	R	"	1	.5	.5	.5	Off	9148									$\Delta T, \Delta T_2, T$ do not conform to req. conditions.	
			.6	40	R	"	1	.5	.5	.5	Off	9149	III				Locked	1.45	.25	.25	Off	"
			.6	20	R	"	1	.2	.2	.2	Off	9150									Good run, not read.	
			.6	20	R	"	1	.2	.2	.2	Off	9151	I	.60	-2.30	R	Locked	1.2	.2	.2	Off	Reduced.
			.7	20	R	"	1	.2	.2	.2	Off	9152									Good run, not read.	
			.7	20	R	"	1	.2	.2	.2	Off	9153									Good run, not read.	
			.7	20	R	"	1	.2	.2	.2	Off	9154	V	.69	-2.30	R	Locked	1.2	.2	.2	Off	Reduced.

\* Direction

**F-80A RUDDER KICK FLIGHT TEST PROGRAM**  
**F-80A #44-85333**

**\* Direction**

FLIGHT LOG

F-80A RUDDER KICK FLIGHT TEST PROGRAM  
F-80A #44-85333

FLT. NO.	DATE 1951	PURPOSE	DATA REQUESTED						DATA OBTAINED						COMMENTS						
			MACH	$\delta_r$	*	$\delta_a$	T	$\Delta T$	$\Delta I_z$	TIP TANKS	RUN	COND.	MACH	$\delta_r$		*	$\delta_a$	T	$\Delta T$	$\Delta I_z$	TIP TANKS
35	7/24	Cond. V VIII	.6	4°	R	Locked	1	.5	.5	Off	9307					Locked	1.1	.48	.2	Off	$T, \Delta T, \Delta I_z$ do not conform to required conditions.
			.6	4°	R	Locked	1	.5	.5	Off	9308					Locked	.9	.48	.2	Off	"
			.6	4°	R	Locked	1	.5	.5	Off	9309					Locked	.9	.2	.2	Off	"
			.6	4°	R	Moved anti-roll	1	.2	.2	Off	9310					Moved anti-roll	Not Reduced				Movement of ailerons did not improve roll rate.
			.6	4°	R	"	1	.2	.2	Off	9311					"	"	"			"
			.7	4°	R	Locked	1	.2	.2	Off	9312					Locked	1.0	.2	.2	Off	Reduced, not present ed.
			.7	4°	R	Locked	1	.2	.2	Off	9313	V	.69	-3.2°	R	Locked	.9	.2	.1	Off	Reduced.
			.6	4°	L	Locked	1	.5	.5	Off	9314					Locked	.9	.4	.15	Off	$T, \Delta T, \Delta I_z$ do not conform to required conditions.
			.6	4°	L	Locked	1	.5	.5	Off	9315					Locked	.9	.3	.2	Off	"
			.6	4°	L	Locked	1	.5	.5	Off	9316					Locked	.9	.25	.2	Off	"
			.6	4°	L	Moved anti-roll	1	.2	.2	Off	9317	VIII	.59	3.8°	L	Moved anti-roll	1.0	.2	.1	Off	Reduced. (Roll rate not minimized).
			.6	1°	L	"	1	.2	.2	Off	9318					"					Good run, not read. (Roll rate not minimized).
			.7	4°	L	Locked	1	.2	.2	Off	9319										Good run, not read. Reduced.
			.7	4°	L	Locked	1	.2	.2	Off	9320	V	.69	4.0°	L	Locked	1.0	.2	.2	Off	Good run, not read. Reduced.
			.7	4°	L	Locked	1	.2	.2	Off	9321										Good run, not read.
			.4	2°	L						9322	IX				Not reduced. Repeated Flt. #36 with sensitivities changed.					
			.4	2°	R						9323	IX				"					On edge of paper.
			.4	4°	R						9324	IX				"					Off paper.
			.4	4°	L						9325	IX				"					
			.4	6°	L						9326	IX				"					
			.4	6°	R						9327	IX				"					
			.4	8°	R						9328	IX				"					
			.4	8°	L						9329	IX				"					Off paper.
			.4	10°	L						9330	IX				"					Off paper.

\*Direction

**F-80A RUDDER KICK FLIGHT TEST PROGRAM**  
**F-80A #44-85333**

### Direction

# FLIGHT LOG

F-80A RUDDER KICK FLIGHT TEST PROGRAM  
F-80A #44-85333

FLT. NO.	DATE 1951	PURPOSE	DATA REQUESTED					DATA OBTAINED							COMMENTS								
			MACH	$\delta_n$	*	$\delta_a$	T	$\Delta T$	$\Delta T_2$	TIP TANKS	RUN	COND.	MACH	$\delta_n$		*	$\delta_a$	T	$\Delta T$	$\Delta T_2$	TIP TANKS		
37	7/26	Cond. III, VIII, IX, X, XI	.4	0°	L					Off	9664	IX	.39							Off	Reduced		
			.4	20°	L					Off	9665	IX	.39							Off	Reduced		
			.4	40°	L					Off	9666	IX	.39							Off	Reduced		
			.4	60°	L					Off	9667	IX	.39							Off	Reduced		
			.4	80°	L					Off	9668	IX	.39							Off	Reduced		
			.4	100°	L					Off	9669	IX	.39							Off	Reduced		
			.6	0°	L					Off	9670	X	.59							Off	Reduced		
			.6	20°	L					Off	9671	X	.59							Off	Reduced		
			.6	40°	L					Off	9672	X	.59							Off	Reduced		
			.6	60°	L					Off	9673	X	.59							Off	Reduced		
			.6	80°	L					Off	9674	X	.59							Off	Reduced		
			.6	100°	L					Off	9675	X	.59							Off	Reduced		
			.7	0°	L					Off	9676	XI	.69							Off	Reduced		
			.7	20°	L					Off	9677	XI	.69							Off	Reduced		
			.7	40°	L					Off	9678	XI	.69							Off	Reduced		
			.7	60°	L					Off	9679	XI	.69							Off	Reduced		
			.7	80°	L					Off	9680	XI	.69							Off	Reduced		
			.7	100°	L					Off	9681	XI	.69							Off	Reduced		
			.6	0°	L					Off	9682	X	.59							Off	Reduced		
			.6	40°	L	Locked	1	.5	.5		Off	9683	III	.59	4°		L Locked	1.3	.4	.5	Off	Good run, not read.	
			.6	40°	L	Locked	1	.5	.5		Off	9684	III								Off	Reduced	
			.6	40°	L	Locked	1	.5	.5		Off	9685	III								Off	Good run, not read.	
			.6	40°	L	Locked	1	.5	.5		Off	9686	III								Off	Good run, not read.	
			.6	40°	L	Locked	1	.5	.5		Off	9687	III								Off	Good run, not read.	
			.6	40°	L	Moved	1	.2	.2		Off	9688	VIII								Off	Good run, not read.	
						anti-roll																	
			.6	40°	L	"	1	.2	.2		Off	9689	VIII	.59	5°		L Moved	1.2	.2	.2	Off	Reduced, unable to prevent roll.	
			.6	40°	L	"	1	.2	.2		Off	9690	VIII								Off	Good run, not read.	
			.6	40°	L	"	1	.2	.2		Off	9691	VIII								Off	Good run, not read.	
			.6	40°	L	"	1	.2	.2		Off	9692	VIII								Off	Good run, not read.	
			.6	40°	L	"	1	.2	.2		Off	9693	VIII								Off	Good run, not read.	

\* Direction

# FLIGHT LOG

F-80A RUDDER KICK FLIGHT TEST PROGRAM  
F-80A #44-85333

FLY. NO.	DATE 1951	PURPOSE	DATA REQUESTED						DATA OBTAINED						COMMENTS						
			MACH	$\delta_e$	#	$\delta_a$	T	$\Delta T$	$\Delta T_2$	TIP TANKS	RUN	COND.	MACH	$\delta_e$		#	$\delta_a$	T	$\Delta T$	$\Delta T_2$	TIP TANKS
38	8/2	Cond. VI VII	.6	4°	R	Locked	1	.2	.2	Half full	9734									Good run, not read.	
			.6	4°	R	"	1	.2	.2	"	9735	VII	.58	-3.5°	R	Locked	1.3	.2	.1	Half full	Reduced
			.6	4°	R	"	1	.2	.2	"	9736										Good run, not read.
			.6	4°	L	"	1	.2	.2	"	9737										Good run, not read.
			.6	4°	L	"	1	.2	.2	"	9738										Good run, not read.
			.6	4°	L	"	1	.2	.2	"	9739	VII	.59	4.4°	L	Locked	1.1	.2	.1	Half full	Reduced
			.6	4°	L	"	1	.2	.2	Empty	9740										Good run, not read.
			.6	4°	L	"	1	.2	.2	Empty	9741										Good run, not read.
			.6	4°	L	"	1	.2	.2	"	9742	VI	.59	4.6°	L	Locked	1.1	.2	.2	Empty	Reduced
			.6	4°	R	"	1	.2	.2	"	9743										Good run, not read.
			.6	4°	R	"	1	.2	.2	"	9744	VI	.59	-3°	R	Locked	1.1	.2	.2	"	Reduced
			.6	4°	R	"	1	.2	.2	"	9745										Good run, not read.
			.6	4°	R	"	.5	.2	.2	"	9746						.8	.2	.1	"	Good run, not read.
			.6	4°	R	"	.5	.2	.2	"	9747	VI	.59	-3.4°	R	Locked	1.5	.2	.2	"	Reduced
			.6	4°	R	"	1.5	.2	.2	"	9748	VI	.59	-3.4°	R	Locked	1.5	.2	.2	"	Reduced
			.6	4°	R	"	1.5	.2	.2	"	9749										Good run, not read.
			.6	0°	R	"				"	9750	X	.60								Reduced
			.6	2°	R	"				"	9751	X	.60								Reduced
			.6	4°	R	"				"	9752	X	.60								Reduced
			.6	4.5°	R	"				"	9753	X	.60								Reduced

\* Direction

# CHANNEL SENSITIVITIES

Channel	Date	Sensitivity	Effective Flights
Rudder Angle	7/9/51	1.796°/in.	32-38
Yaw Rate	7/16/51	2.61°/sec/in.	32, 33
	7/16/51	3.99°/sec/in.	34, 35
	8/1/51	4.08°/sec/in.	36-38
Fin Shear	7/13/51	825#/in.	32, 33
		803#/in.	34
		808#/in.	35, 36
		820#/in.	37
		810#/in.	38
Fin Bending Moment	7/13/51	16,650 in.#/in.	32, 33
		15,534 in.#/in.	34
		15,686 in.#/in.	35, 36
		16,560 in.#/in.	37
		16,110 in.#/in.	38
Normal Acceleration	5/15/51	1.935 g/in.	32-38
Roll Rate	7/16/51	12.75°/sec/in.	32-35
	7/26/51	12.31°/sec/in.	36-38
Aileron Deflection	7/16/51	4.57°/in.	32-38
Elevator Deflection	6/28/51	2.45°/in.	32-38
Sideslip Angle	6/28/51	11.42 in H <sub>2</sub> O/in.	32-38
Right Stabilizer Shear	7/11/51	303#/in.	32-34
	7/24/51	312#/in.	35-38
Left Stabilizer Shear	7/11/51	338#/in.	32-34
	7/24/51	351#/in.	35-38
Right Stabilizer Bending Moment	7/11/51	14,350 in.#/in.	32-34
	7/24/51	13,500 in.#/in.	35-38
Left Stabilizer Bending Moment	7/11/51	13,700 in.#/in.	32-34
	7/24/51	12,800 in.#/in.	35-38

# F-80A SIGN CONVENTION

ARROWS SHOW POSITIVE QUANTITIES

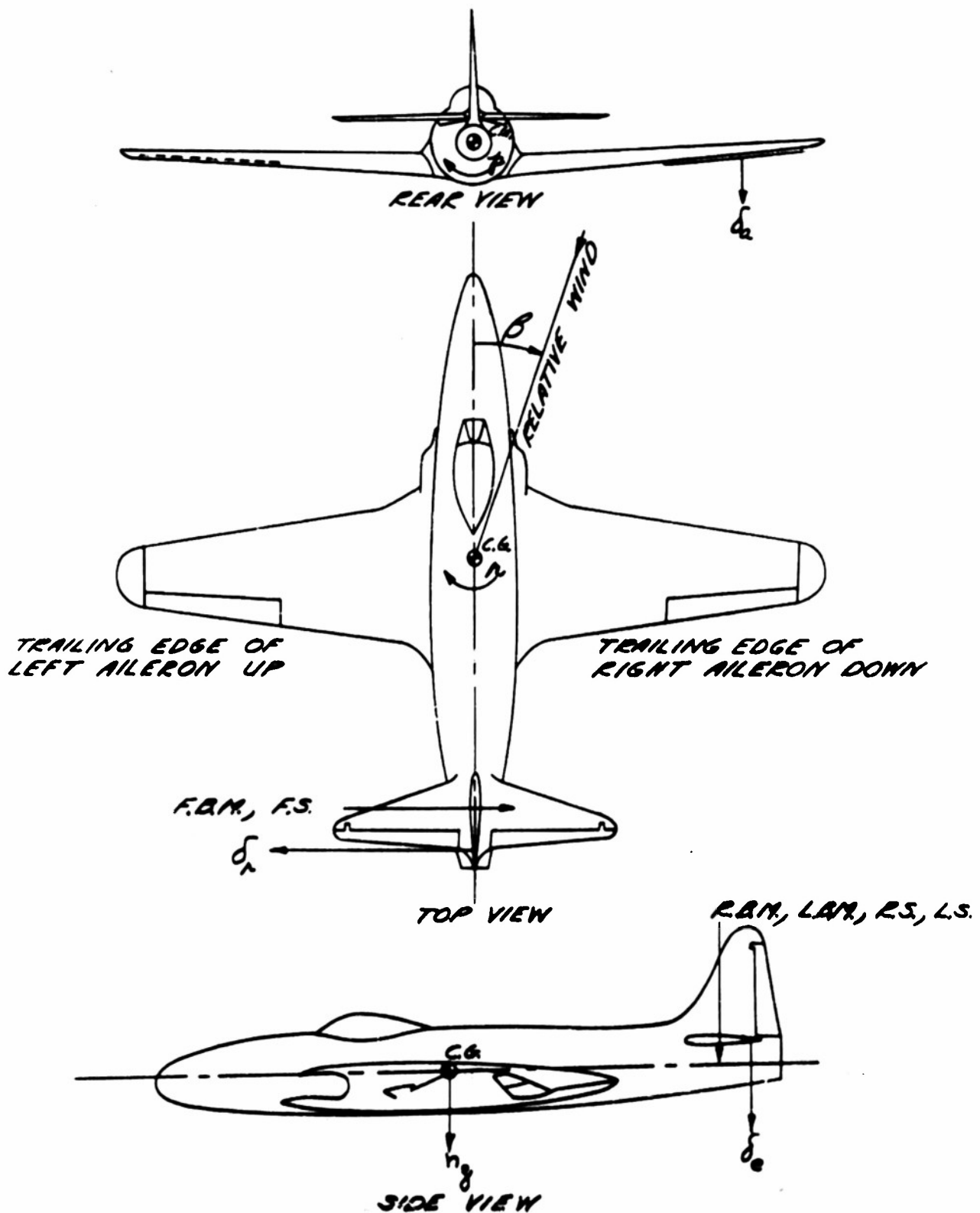


Figure 3

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 34

RUDDER  $\delta_r$  3.9°

RUN 9208

KICK DURATION  $T_1$  1.3 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 27,920 FT.

TIME TO RETURN  $\Delta T_2$  .3 SEC

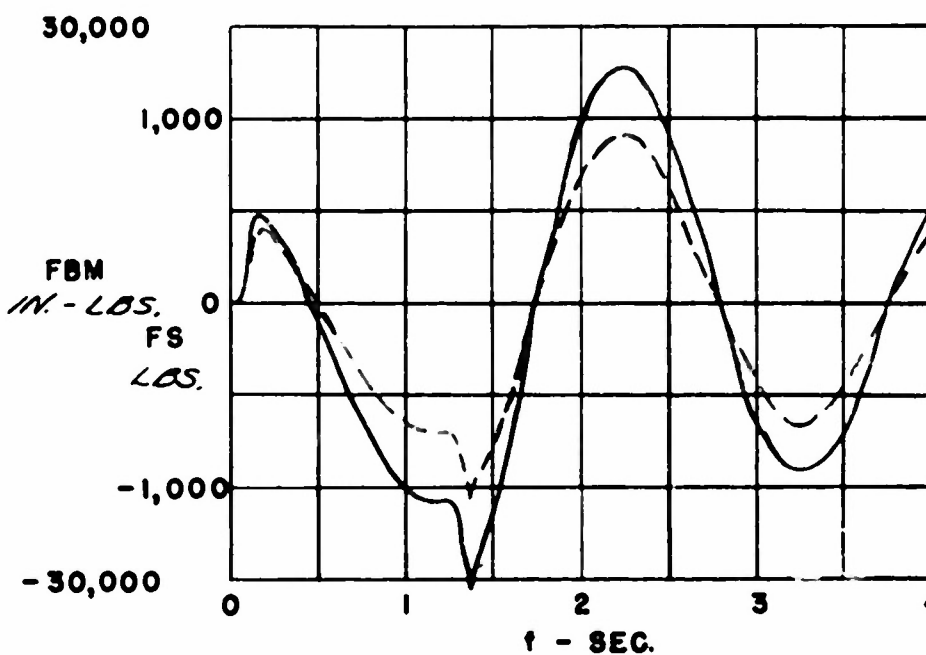
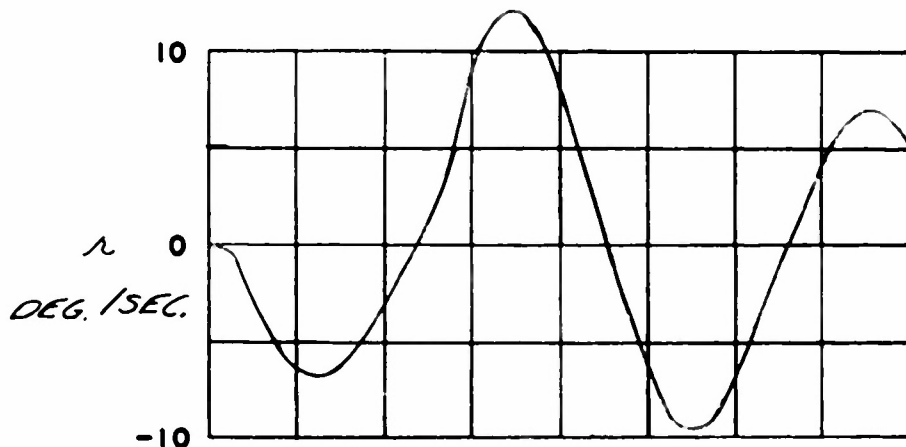
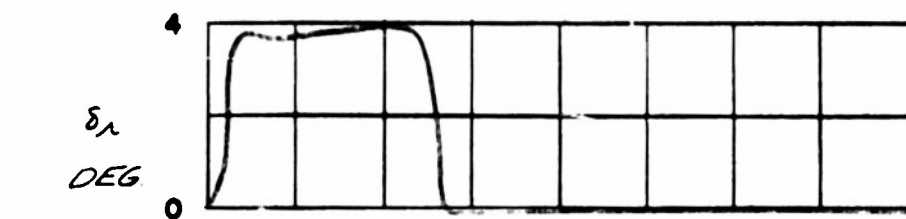
O.A.T. -13.6°

AILERON LOCKED

$V_0$  303.2 KPH

CONDITION I

$P =$



— FBM  
- - - FS

Figure 4

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 34

RUDDER  $\delta_r$  3.9%

RUN 9208

KICK DURATION  $T_1$  1.3 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,194 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -130 °C

AILERON LOCKED

$V_0$  303.2 MPH

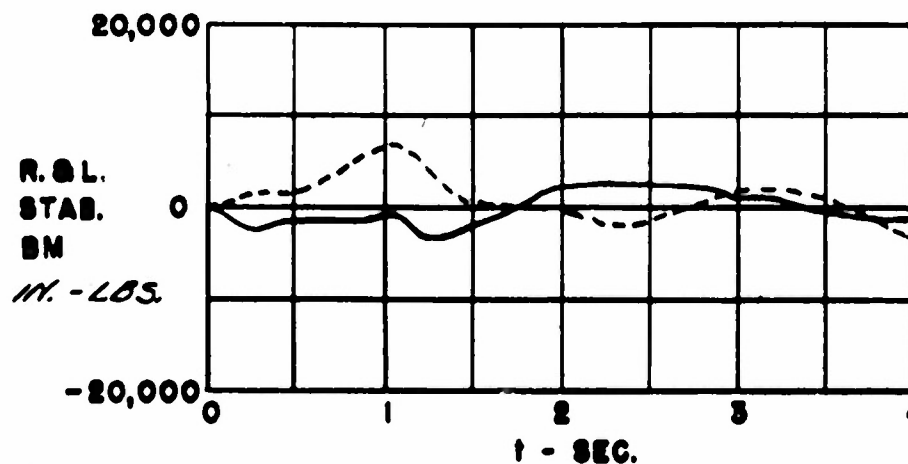
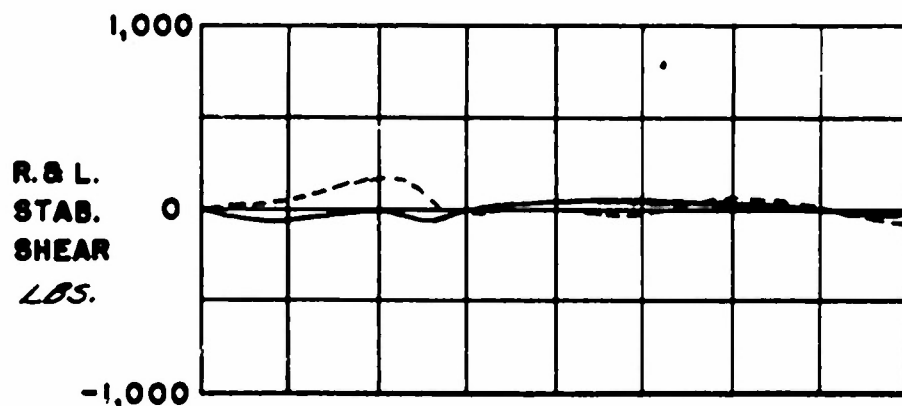
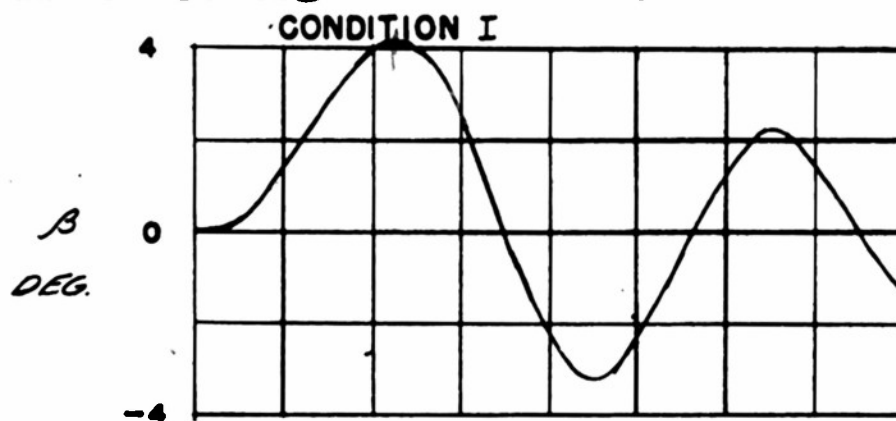


Figure 5

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59  
 RUDDER  $\delta_R$  3.5°  
 KICK DURATION  $T_1$  1.0 SEC.  
 TIME TO APPLY  $\Delta T_1$  0.5 SEC.  
 TIME TO RETURN  $\Delta T_2$  .2 SEC.  
 AILERON LOCKED

FLIGHT 34  
 RUN 9208  
 TIP TANKS OFF  
 ALTITUDE 20,194 FT.  
 O.A.T. -13.0 °C  
 $V_0$  3035 MPH

## CONDITION I

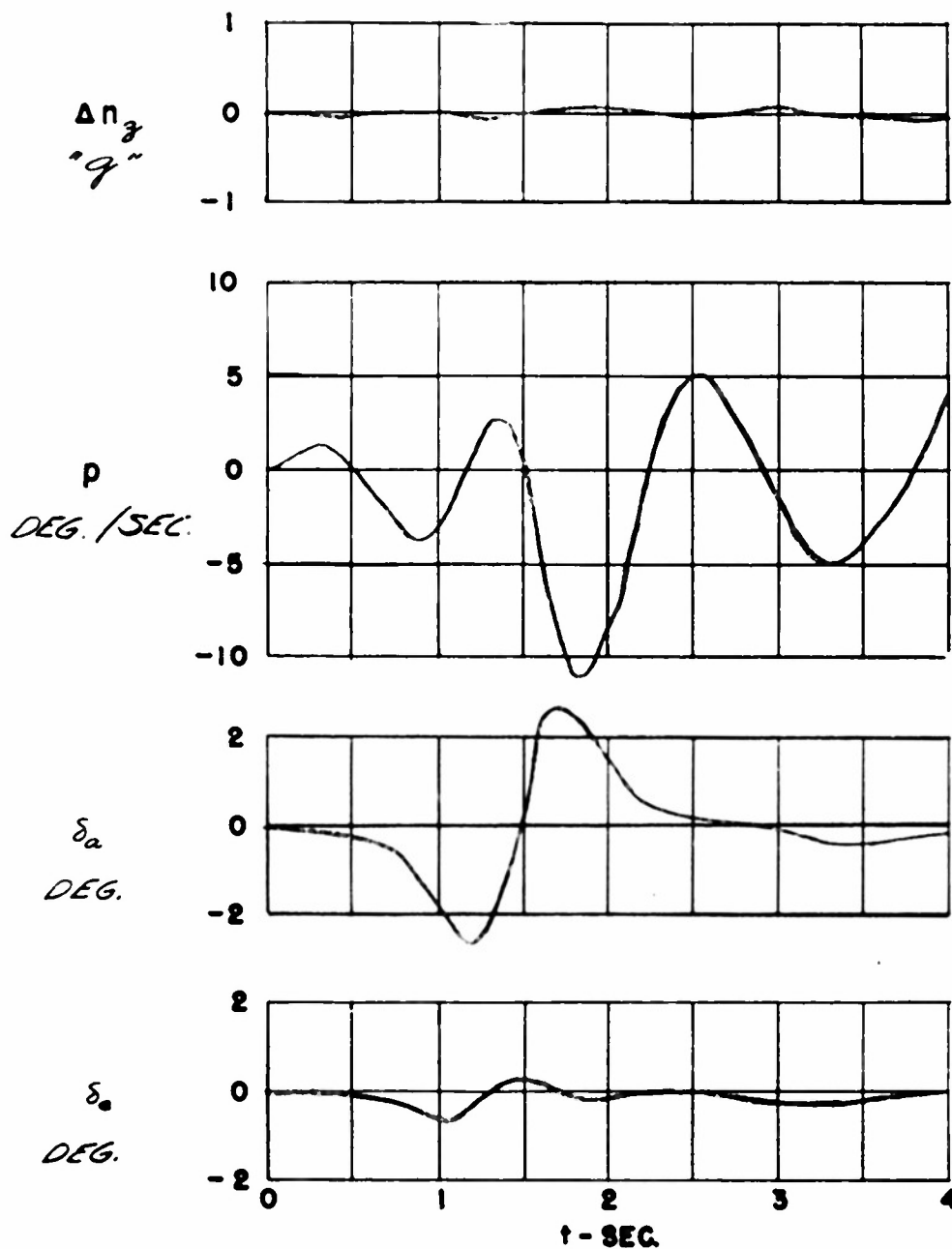


Figure 6

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58

FLIGHT 34

RUDDER  $\delta_R$  4.8°

RUN 9215

KICK DURATION  $T_1$  .12 SEC

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 20,035 FT

TIME TO RETURN  $\Delta T_2$  .1 SEC

O.A.T. -13.0°

AILERON LOCKED

$V_0$  298.5 MPH

CONDITION I

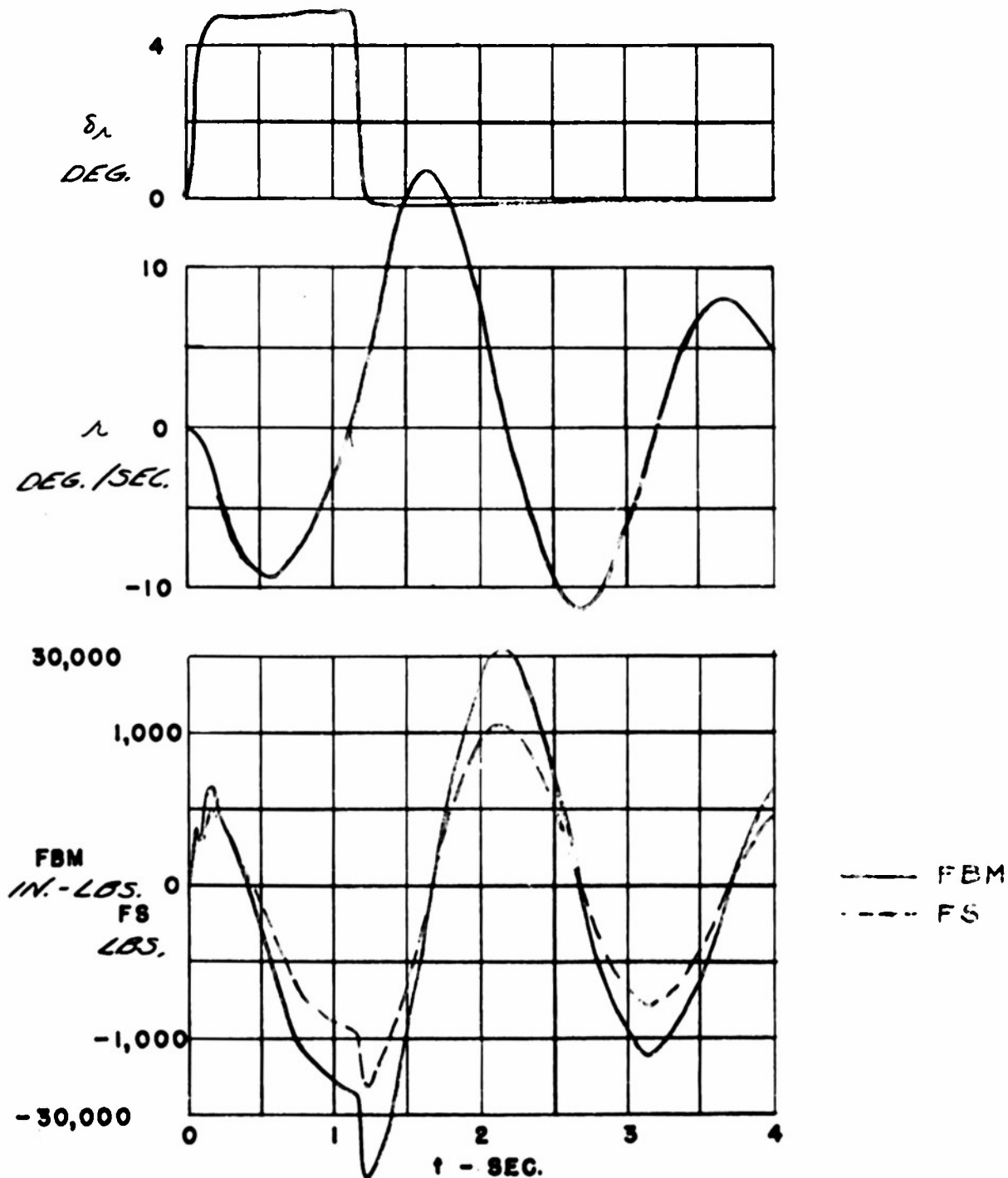


Figure 7

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .50

RUDDER  $\delta_R$  4.8°

KICK DURATION  $T_1$  1.2 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .1 SEC

AILERON LOCKED

FLIGHT 34

RUN 9215

TIP TANKS OFF

ALTITUDE 20,035 FT.

O.A.T. -130 °C

$V_0$  298.5 MPH

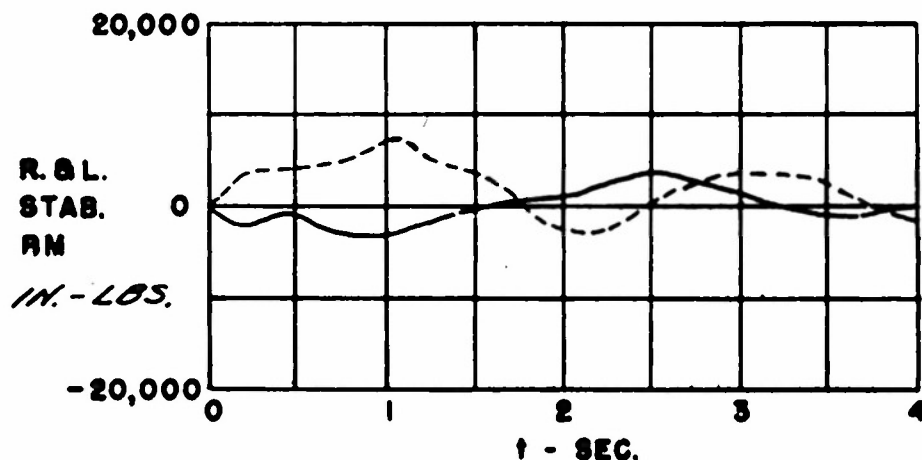
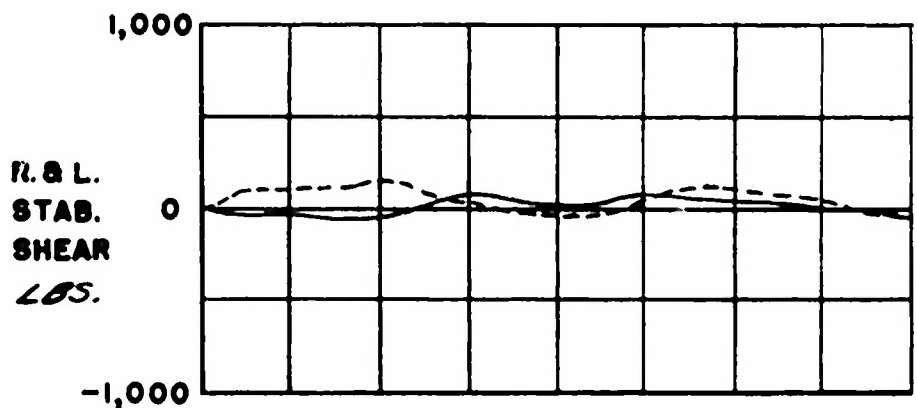
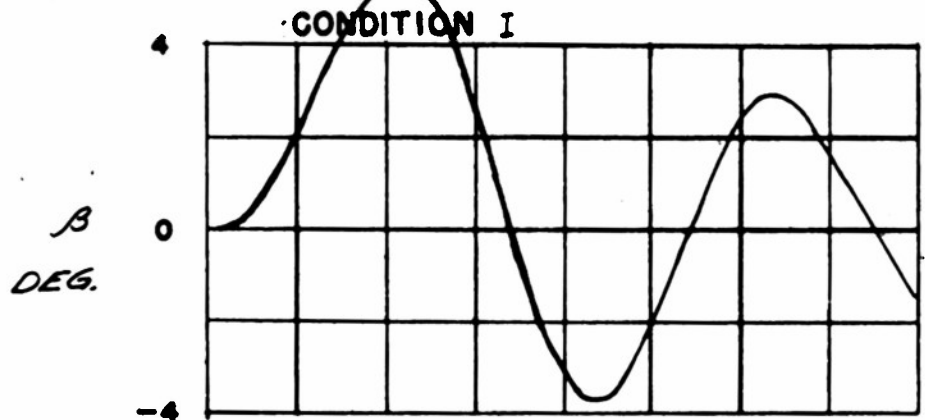


Figure 8

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER 58

FLIGHT 34

RUDDER  $\delta_R$  4.8%

RUN 9215

KICK DURATION  $T_1$  1.2 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,035 FT

TIME TO RETURN  $\Delta T_2$  .1 SEC

O.A.T. -13.0 °C

AILERON LOCKED

$V_0$  298.5 MPH

## CONDITION I

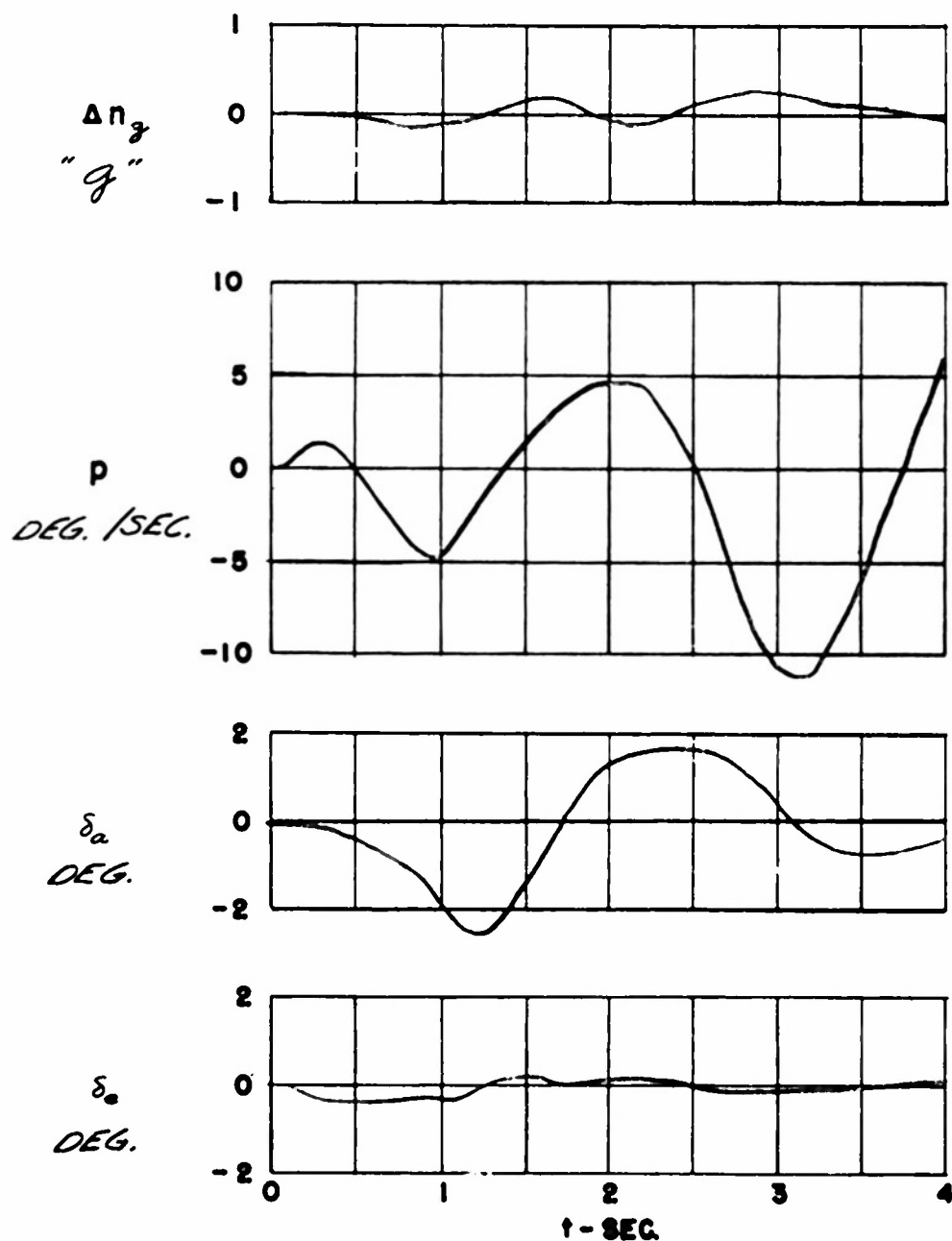


Figure 9

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER 59

FLIGHT 34

RUDDER  $\delta_R$  2.5%

RUN 9218

KICK DURATION  $T_1$  1.9 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 29,000 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. 12.7%

AILERON LOCKED

$V_0$  305.9 MPH

CONDITION I

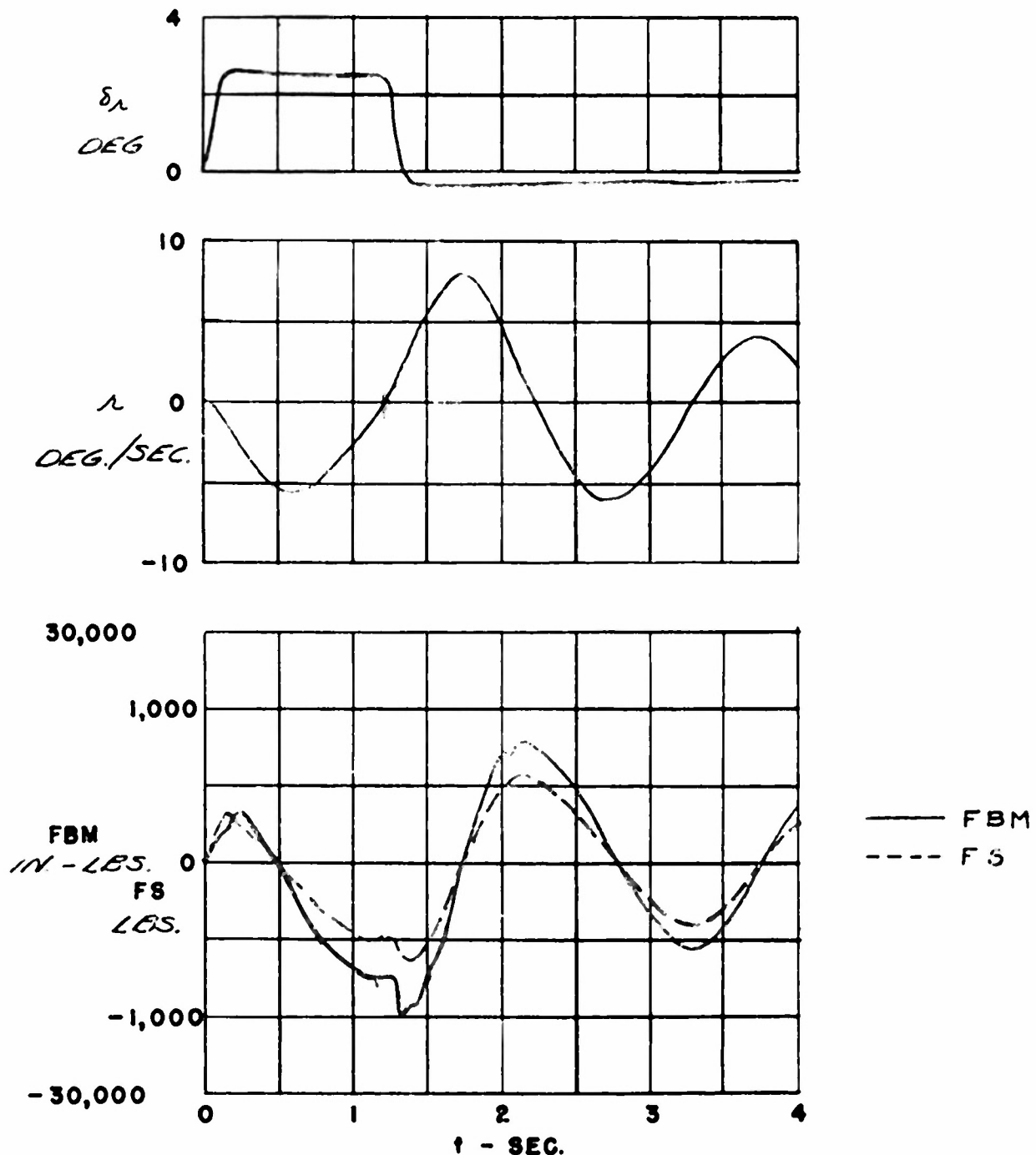


Figure 10

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  2.5°

KICK DURATION  $T_1$  1.4 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC

AILERON LOCKED

FLIGHT 34

RUN 9218

TIP TANKS OFF

ALTITUDE 20018 FT.

O.A.T. -12.7°C

$V_0$  302.9 MPH

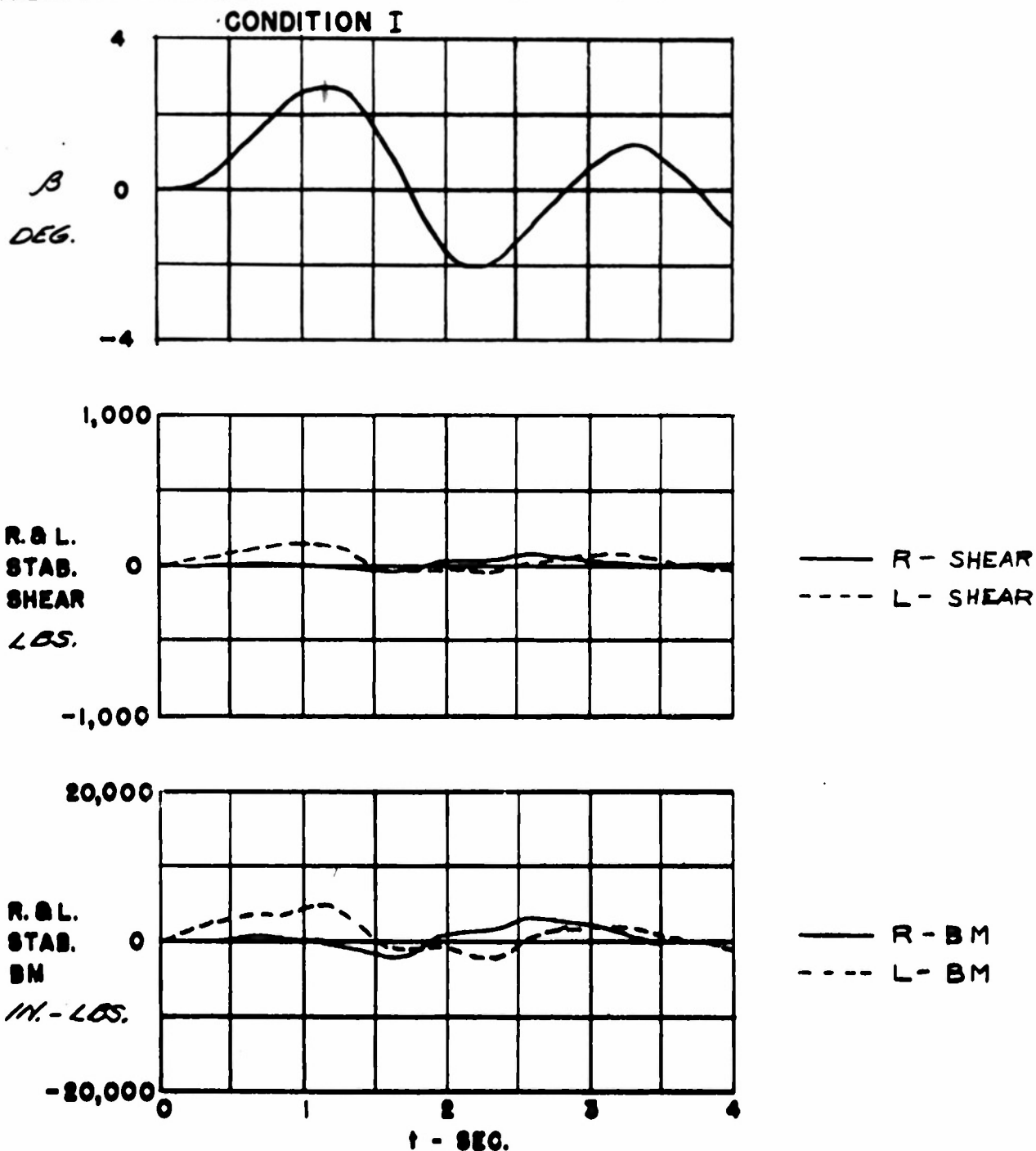


Figure 11

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  2.5%

KICK DURATION  $T_1$  1.4 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC

AILERON LOCKED

FLIGHT 34

RUN 9218

TIP TANKS OFF

ALTITUDE 20,000 FT

O.A.T. -12.7 °C

$V_0$  302.9 MPH

CONDITION I

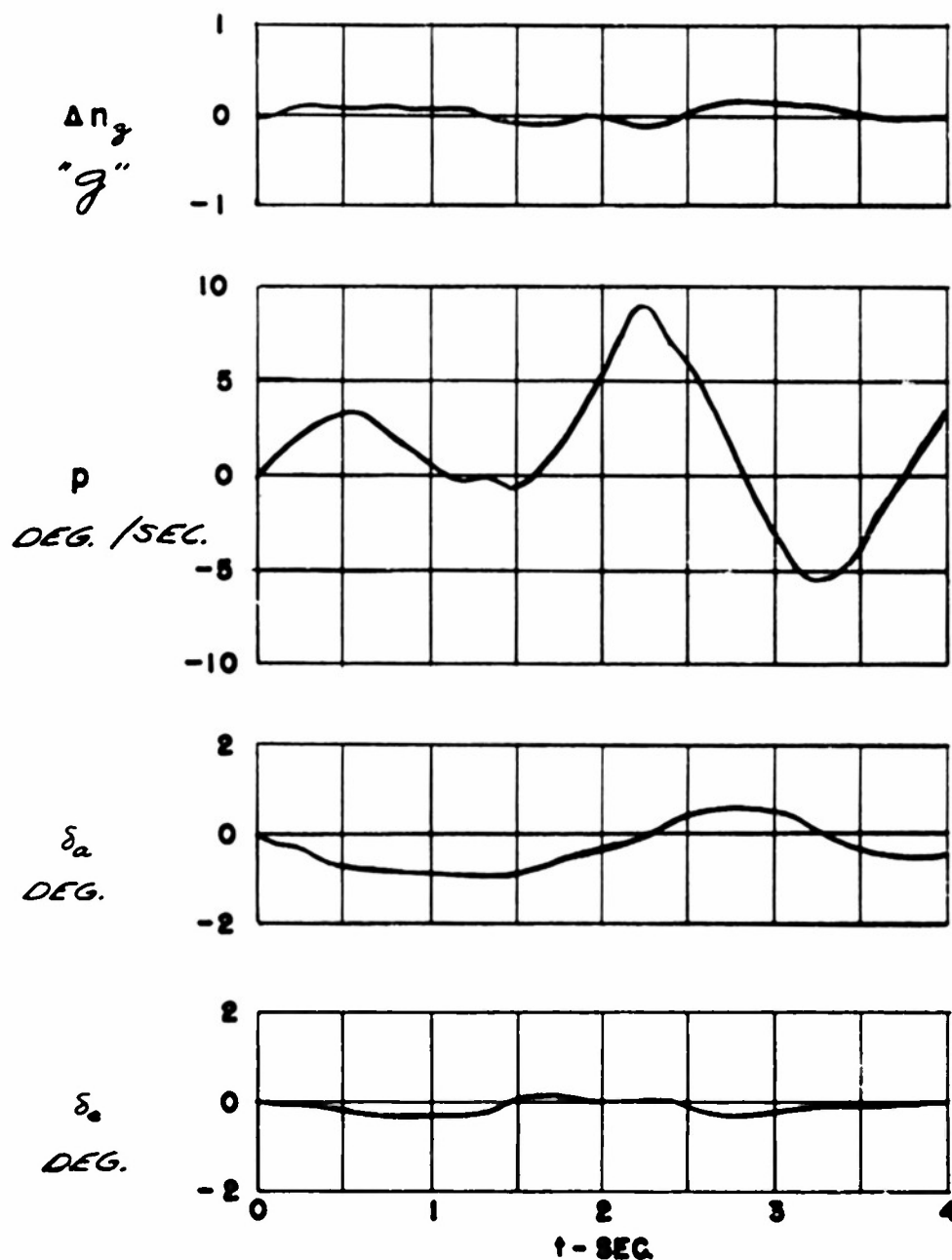


Figure 12

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .60

FLIGHT 33

RUDDER  $\delta_R$  3.0°R

RUN 9140

KICK DURATION  $T_1$  1.25 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20200 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -17.4°C

AILERON LOCKED

$V_0$  307.1 MPH

## CONDITION I

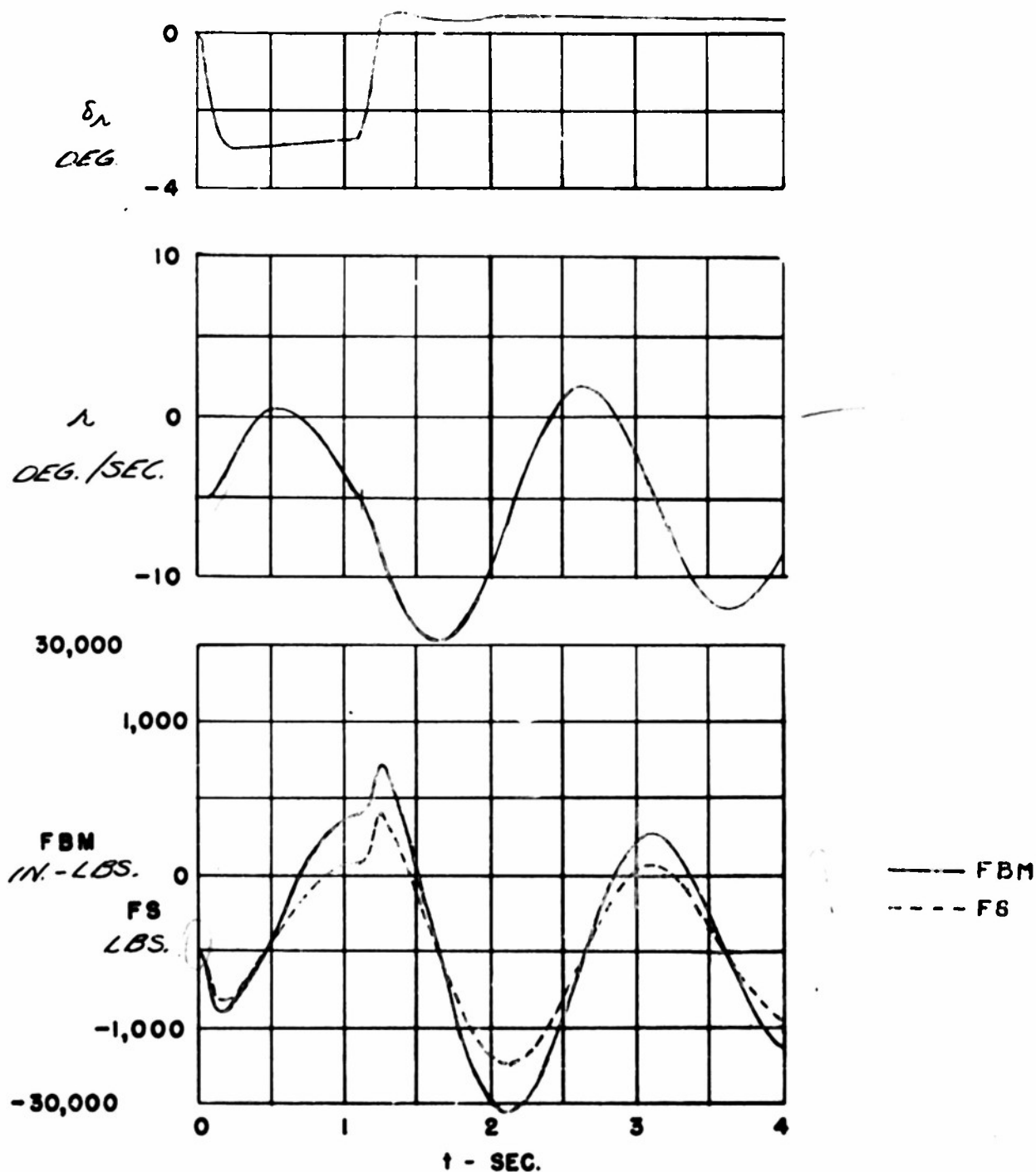


Figure 13

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .6

FLIGHT 33

RUDDER  $\delta_R$  3.0°R

RUN 3140

KICK DURATION  $T_1$  1.25 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,200 FT

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. - 17.4°C

AILERON LOCKED

$V_0$  307.1 MPH

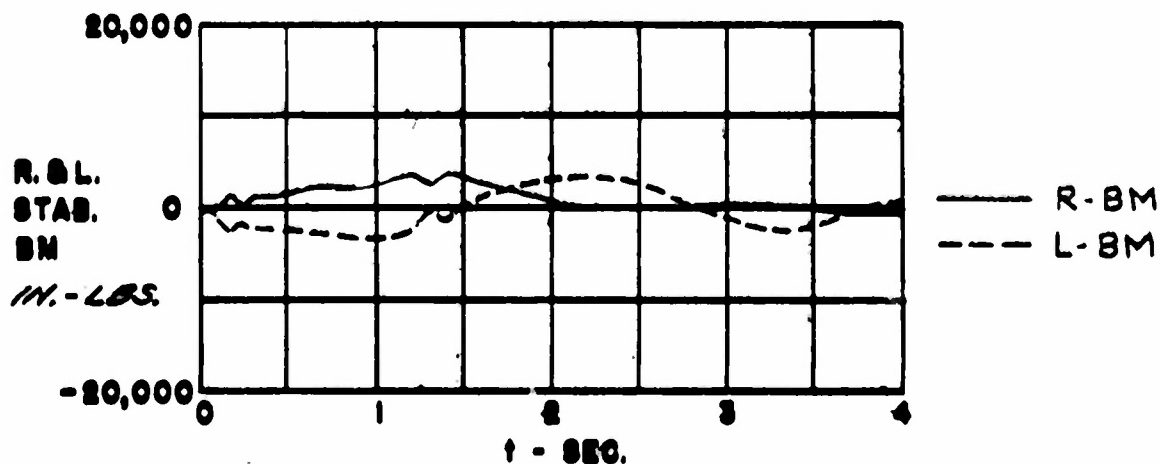
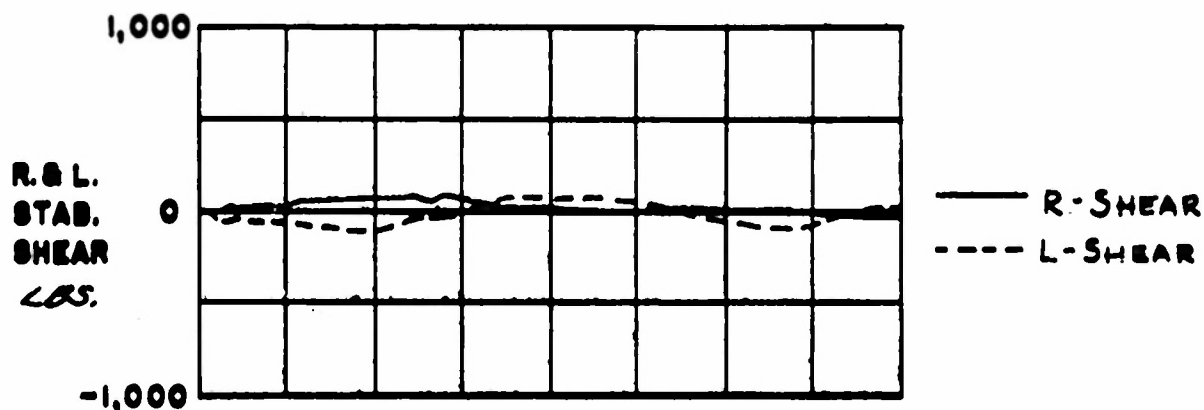
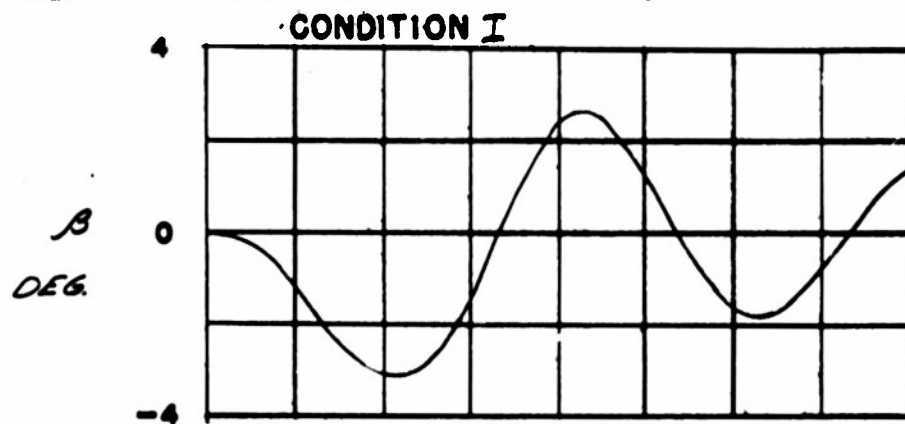


Figure 14

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .6  
 RUDDER  $\delta_r$  3.0°  
 KICK DURATION  $T_1$  1.25 SEC.  
 TIME TO APPLY  $\Delta T_1$  2 SEC.  
 TIME TO RETURN  $\Delta T_2$  2 SEC.  
 AILERON LOCKED

FLIGHT 33  
 RUN 9140  
 TIP TANKS OFF  
 ALTITUDE 20,200 FT  
 O.A.T. -17.4°C  
 $V_0$  307.1 MPH

## CONDITION I

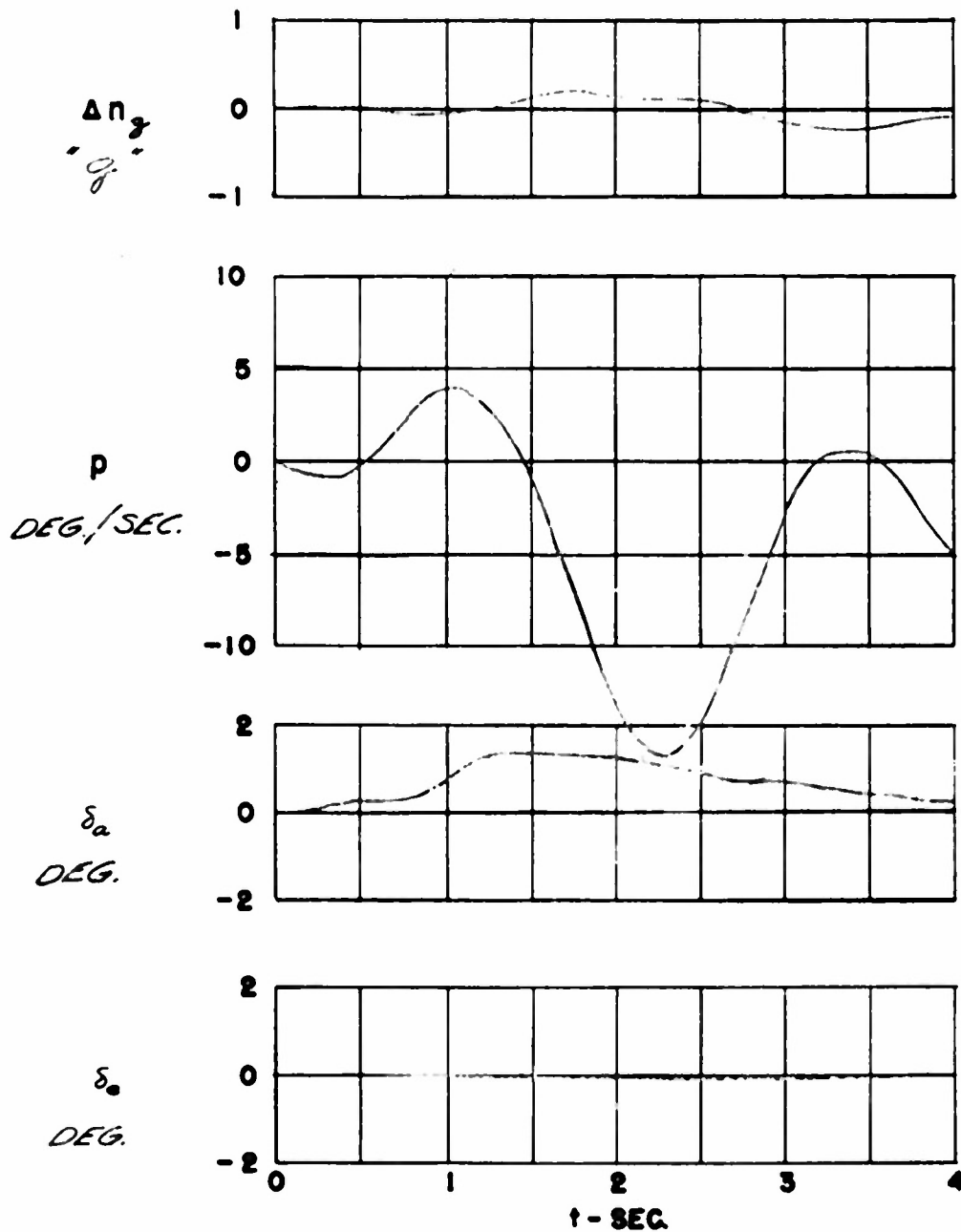


Figure 15

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .50  
 RUDDER  $\delta_R$  2 DEG  
 KICK DURATION  $T_1$  1.2 SEC  
 TIME TO APPLY  $\Delta T_1$  .2 SEC  
 TIME TO RETURN  $\Delta T_2$  .1 SEC  
 AILERON 100000

FLIGHT 33  
 RUN 9151  
 TIP TANKS OFF  
 ALTITUDE 20,110 FT  
 O.A.T. -17.4°C  
 $V_0$  0.067 MPH

CONDITION I

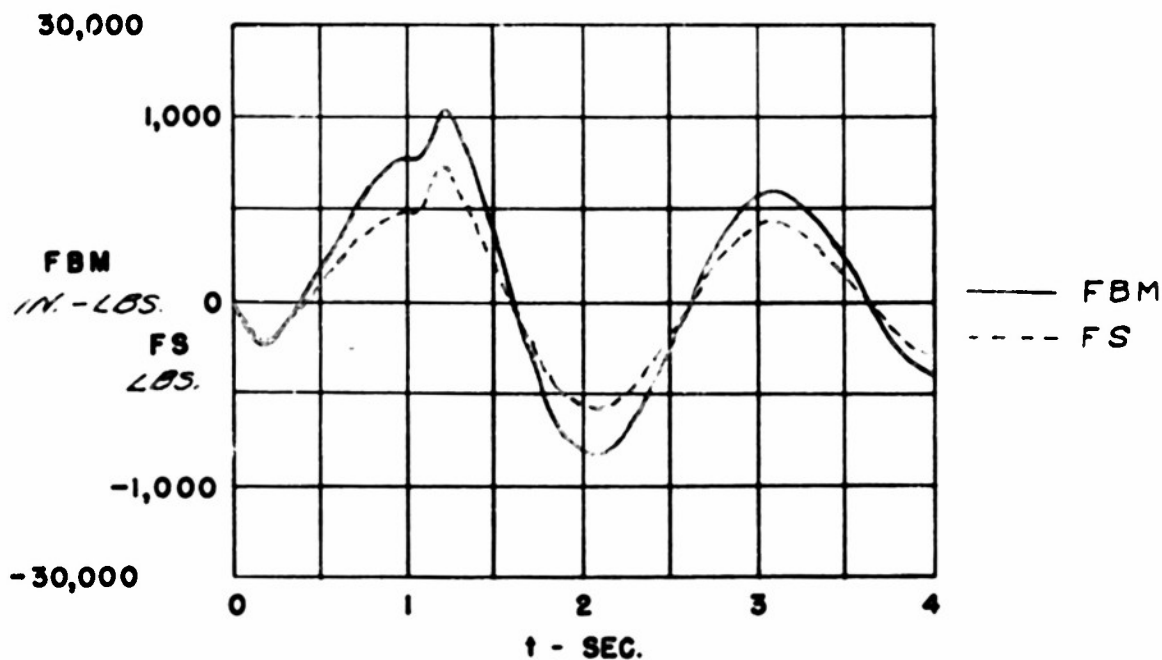
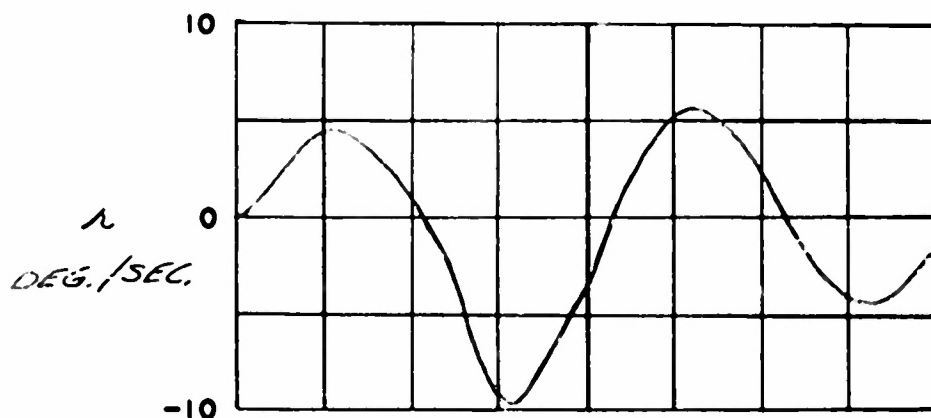
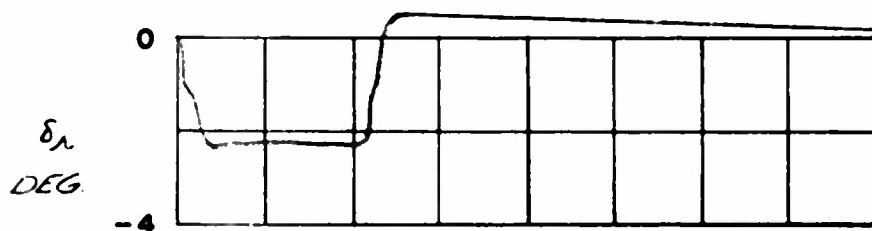


Figure 16

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .60

FLIGHT 33

RUDDER  $\delta_R$  2.3°

RUN 9151

KICK DURATION  $T_1$  1.2 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,110 FT.

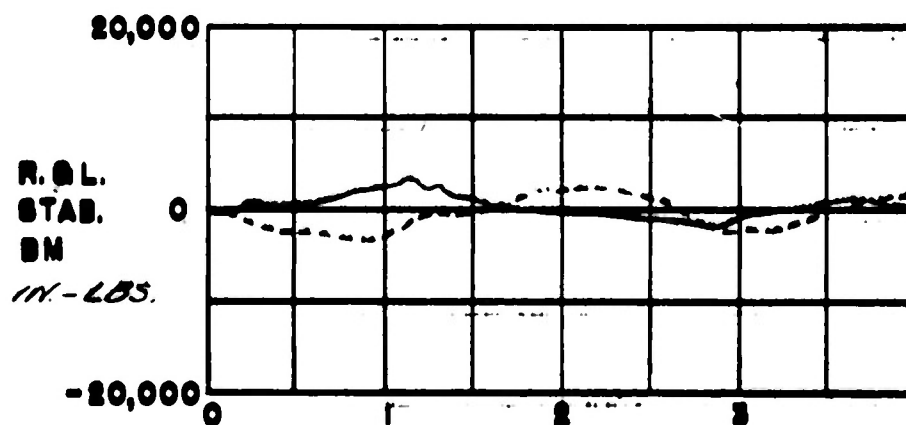
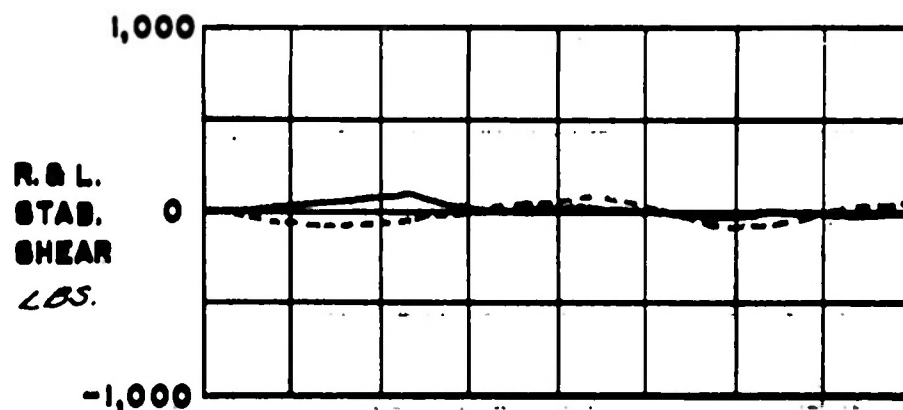
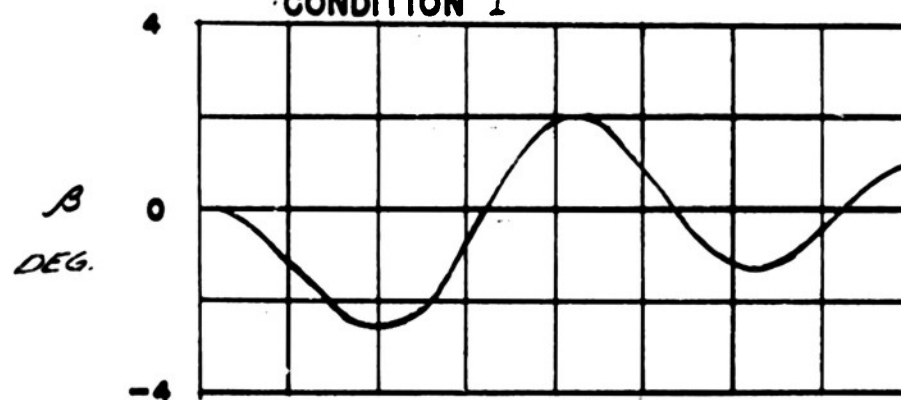
TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -17.4°C

AILERON LOCKED

$V_0$  306.4 MPH

CONDITION I



t - SEC.  
Figure 17

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER.60

RUDDER  $\delta_R$  2.3°R

KICK DURATION  $T_1$  1.2 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 33

RUN 9131

TIP TANKS OFF

ALTITUDE 29,110 FT.

O.A.T. -17.4 °C

$V_0$  306.4 MPH.

## CONDITION I

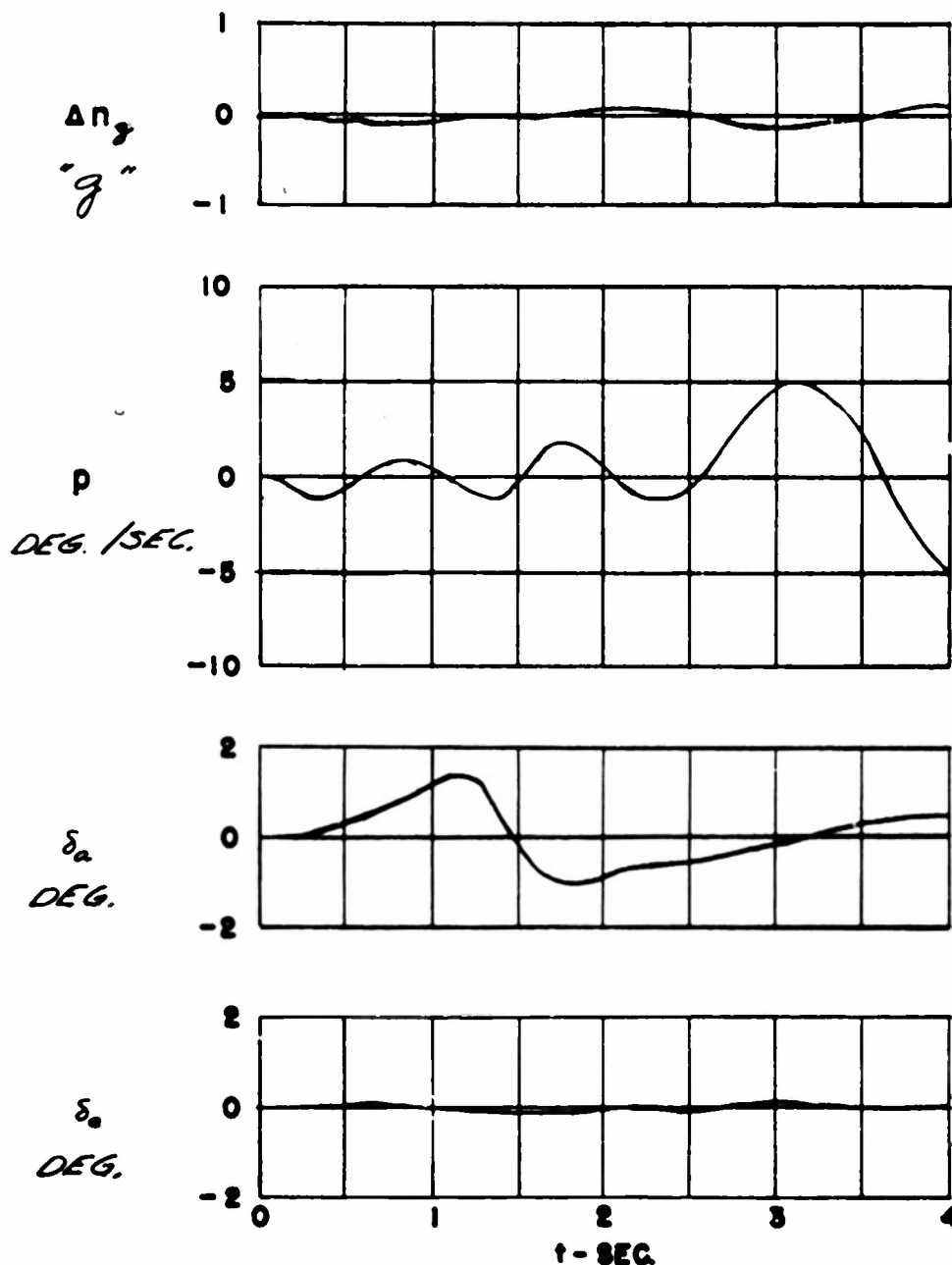


Figure 18

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58  
 RUDDER  $\delta_R$  4.2°  
 KICK DURATION  $T_1$  .8 SEC  
 TIME TO APPLY  $\Delta T_1$  .2 SEC  
 TIME TO RETURN  $\Delta T_2$  .2 SEC  
 AILERON LOCKED  
 CONDITION I-2

FLIGHT 34  
 RUN 9213  
 TIP TANKS OFF  
 ALTITUDE 20,144 FT.  
 O.A.T. -12.7°C  
 $V_0$  298.7 MPH

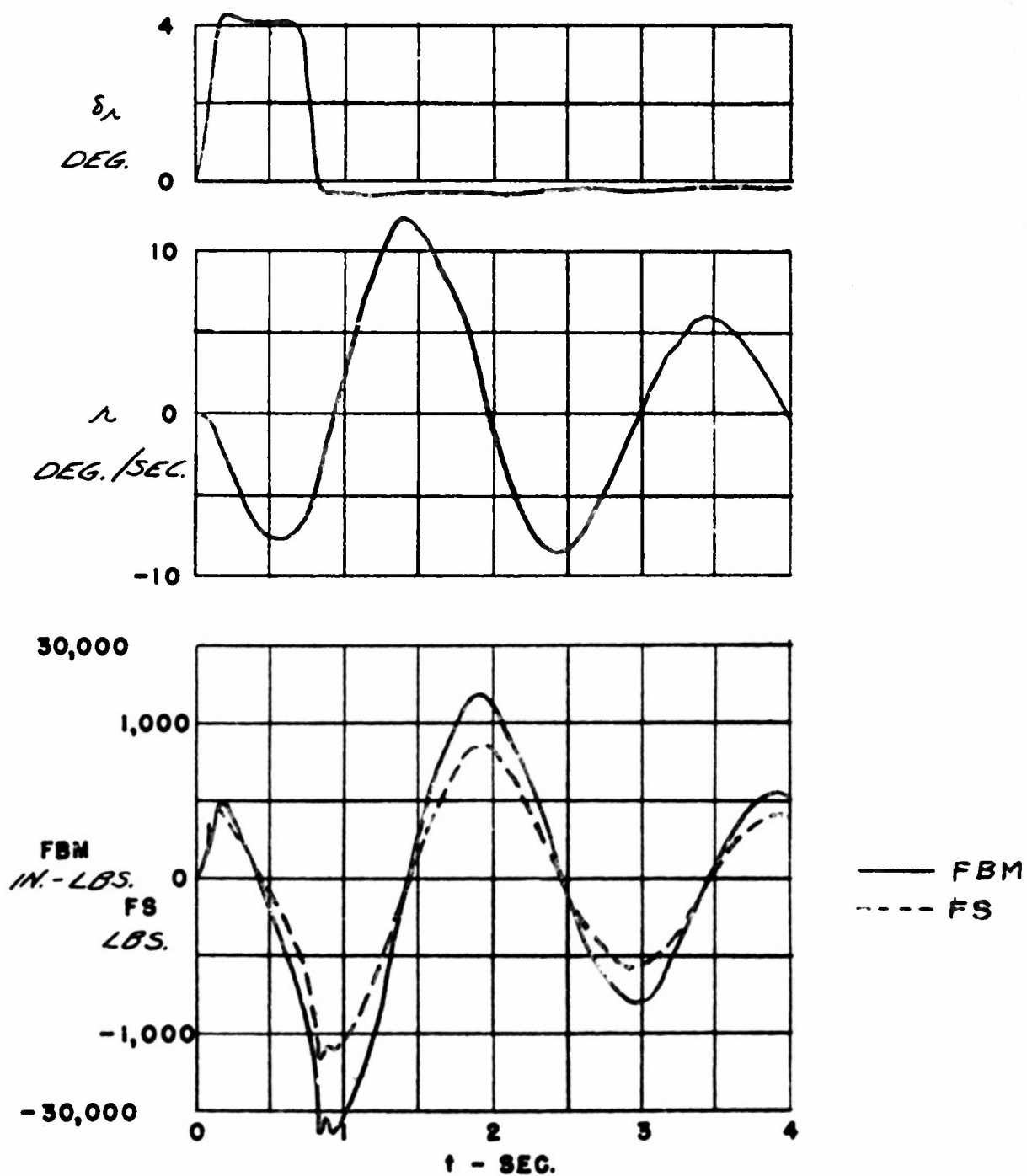


Figure 19

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58

RUDDER  $\delta_R$  4.2°

KICK DURATION  $T_1$  .8 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 34

RUN 9213

TIP TANKS OFF

ALTITUDE 20,144 FT.

O.A.T. -12.7°C

$V_0$  298.7 MPH

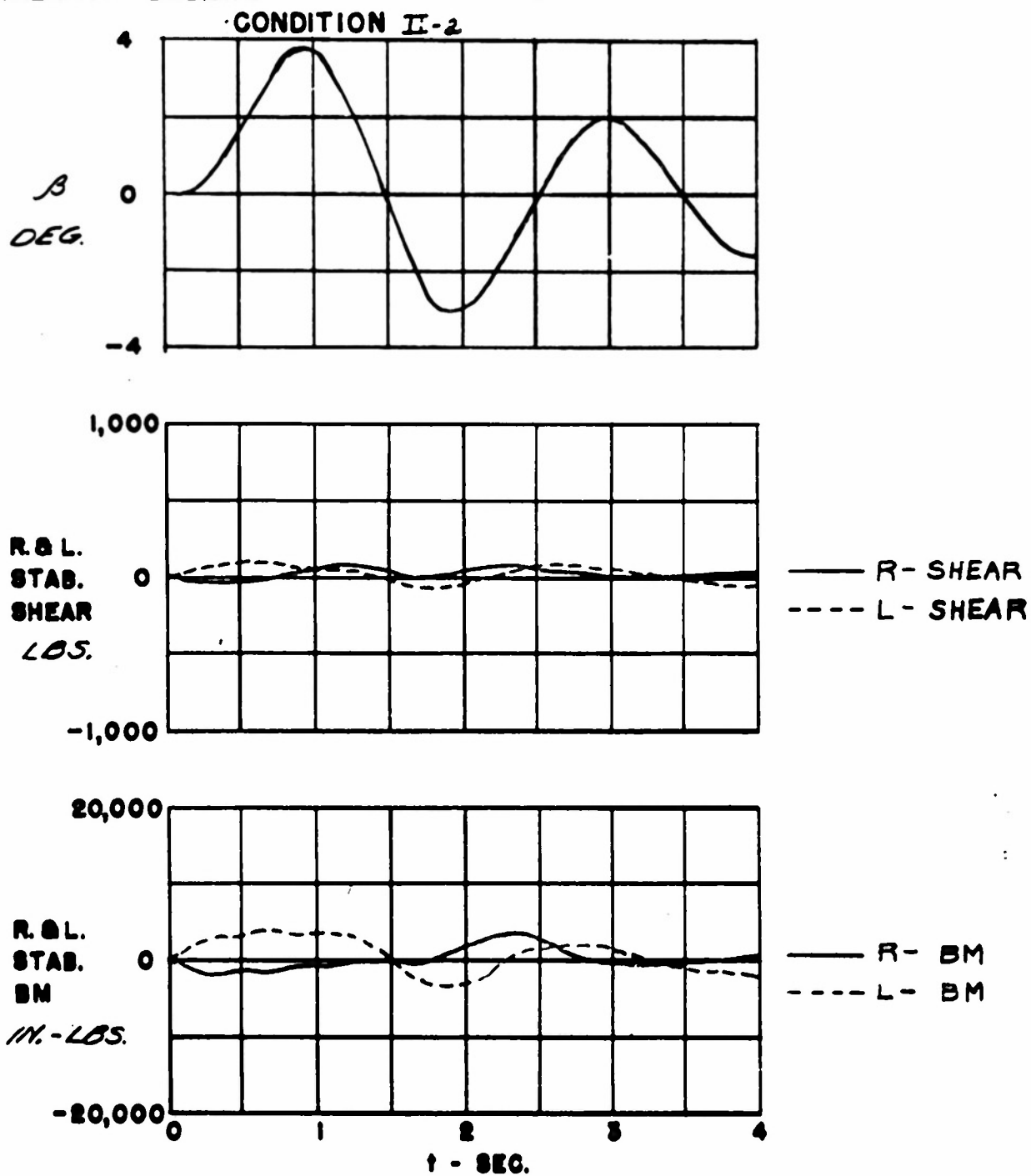


Figure 20

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58

RUDDER  $\delta_R$  4.2%

KICK DURATION  $T_1$  .8 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 34

RUN 9213

TIP TANKS OFF

ALTITUDE 20,144 FT.

O.A.T. -12.7 °C

$V_0$  298.7 MPH

CONDITION II-a

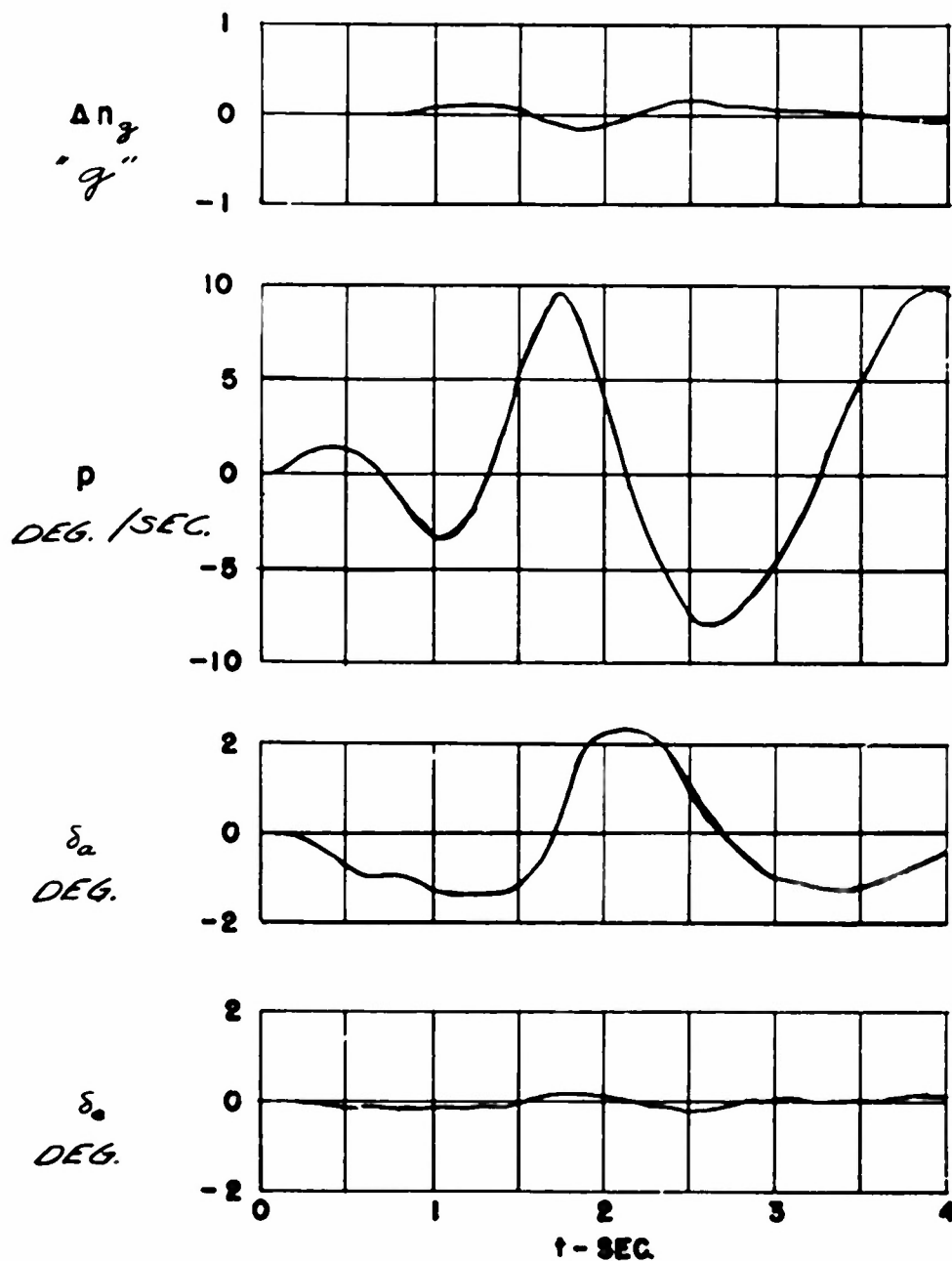


Figure 21

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59  
 RUDDER  $\delta_R$  3.0°  
 KICK DURATION  $T_1$  1.5 SEC.  
 TIME TO APPLY  $\Delta T_1$  .1 SEC  
 TIME TO RETURN  $\Delta T_2$  .2 SEC  
 AILERON LOCKED

FLIGHT 33  
 RUN 9144  
 TIP TANKS OFF  
 ALTITUDE 20,500 FT.  
 O.A.T. -18.3 °C  
 $V_0$  308.9 MPH

CONDITION  $\Gamma$ -2

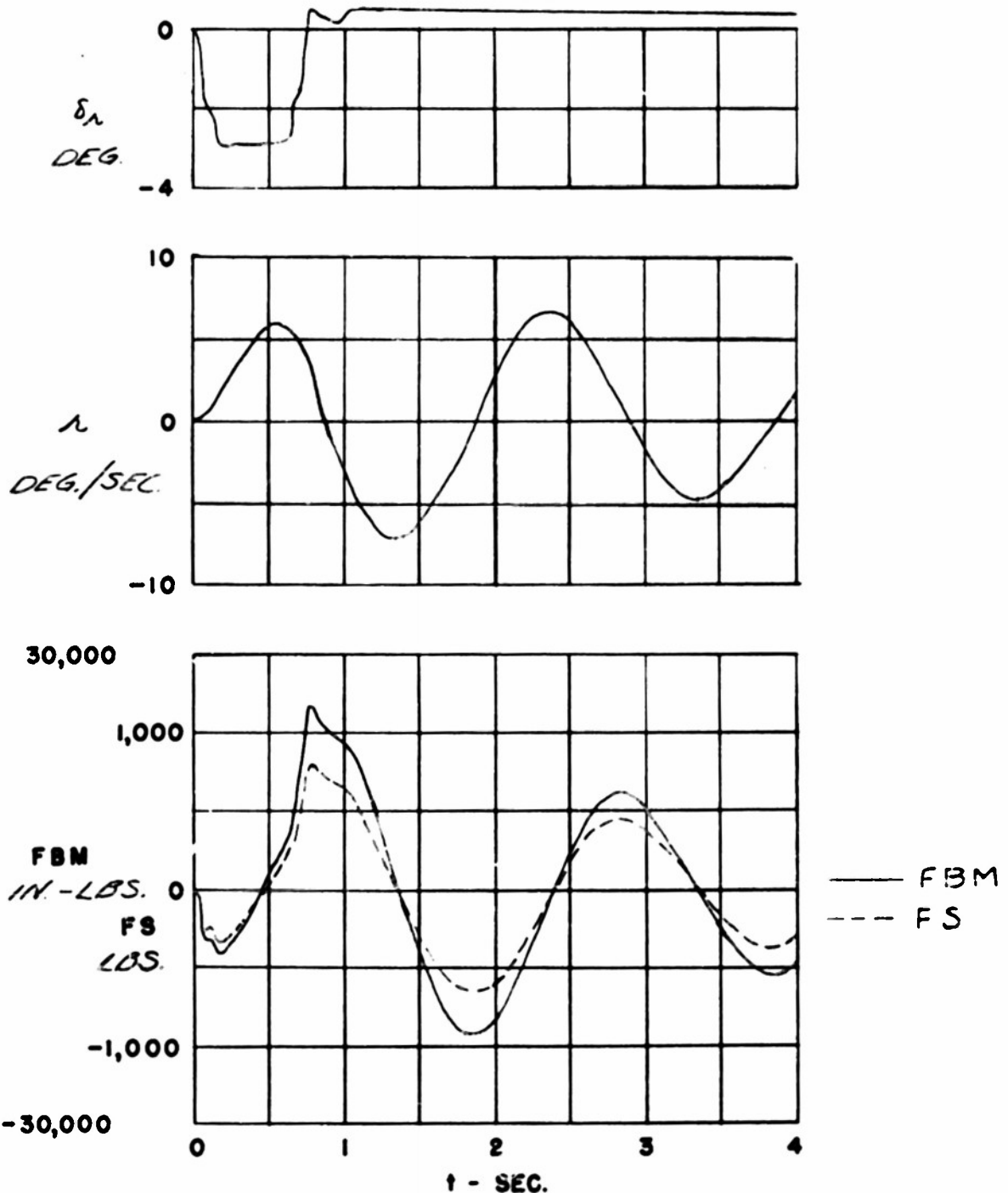


Figure 22

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 33

RUDDER  $\delta_R$  3.0°R

RUN 9144

KICK DURATION  $T_1$  .75 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 29500 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -18.3°C

AILERON LOCKED

$V_0$  303.9 MPH

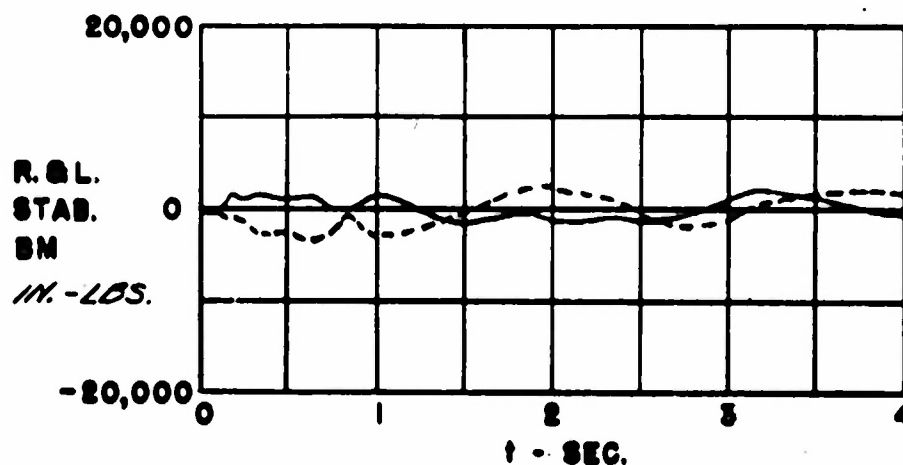
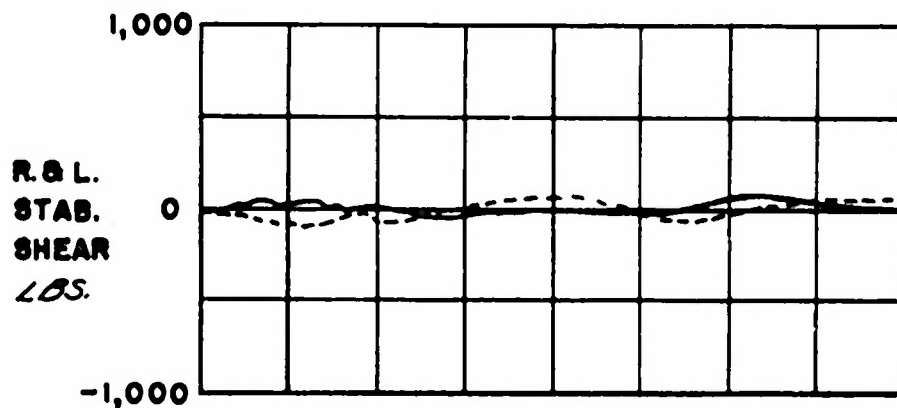
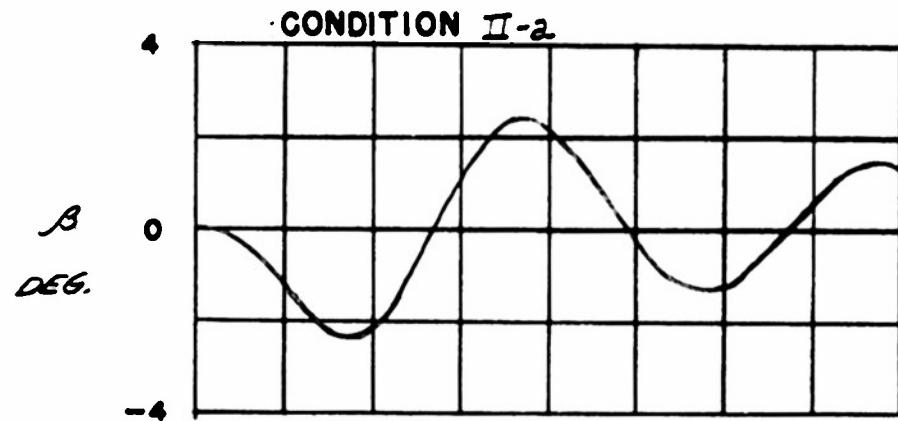


Figure 23

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  30°R

KICK DURATION  $T_1$  .75 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 33

RUN 9144

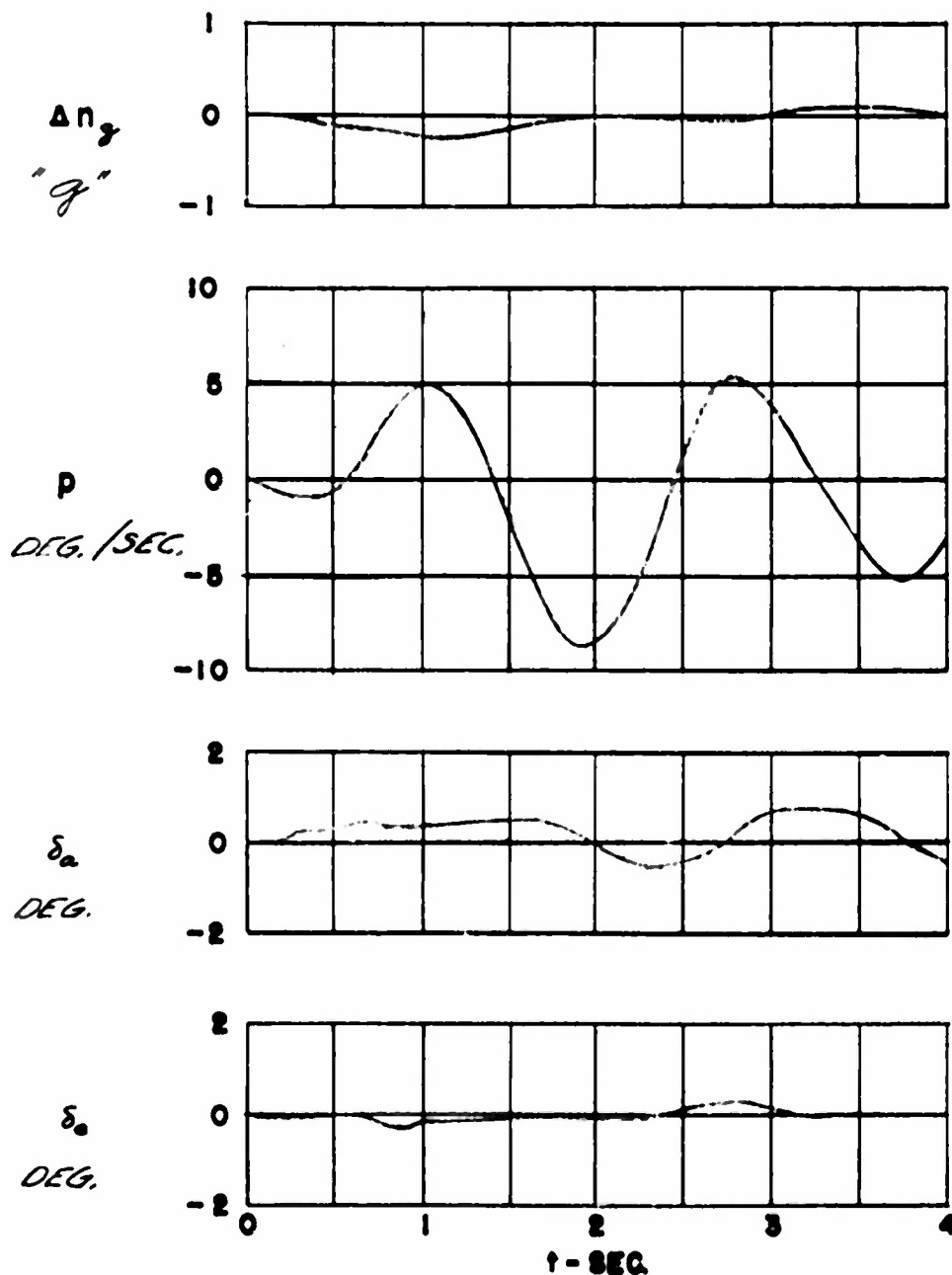
TIP TANKS OFF

ALTITUDE 20,500 FT.

O.A.T. -18.3 °C

$V_0$  303.9 MPH

CONDITION II-a.



t - SEC.

Figure 24

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .56

FLIGHT 34

RUDDER  $\delta_R$  4.3%

RUN 9210

KICK DURATION  $T_1$  1.9 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  2 SEC.

ALTITUDE 20,058 FT.

TIME TO RETURN  $\Delta T_2$  2 SEC.

O.A.T. -12.5°C

AILERON LOCKED

$V_0$  299.8 MPH

CONDITION II-b

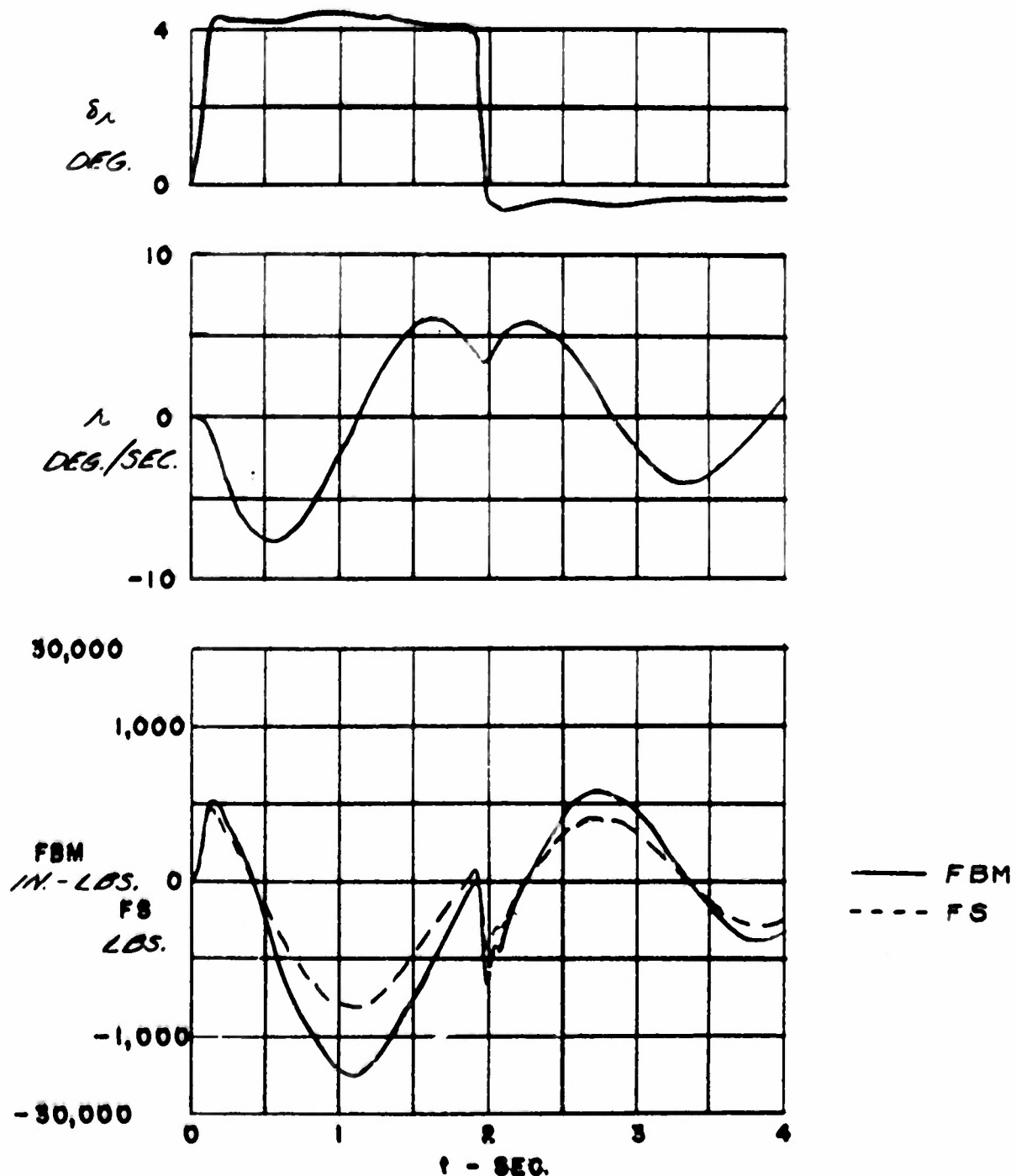


Figure 25

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .56

RUDDER  $\delta_R$  4.3%

KICK DURATION  $T_1$  1.9 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 34

RUN 9210

TIP TANKS OFF

ALTITUDE 20,050 FT.

O.A.T. -12.5°C

$V_0$  299.8 MPH

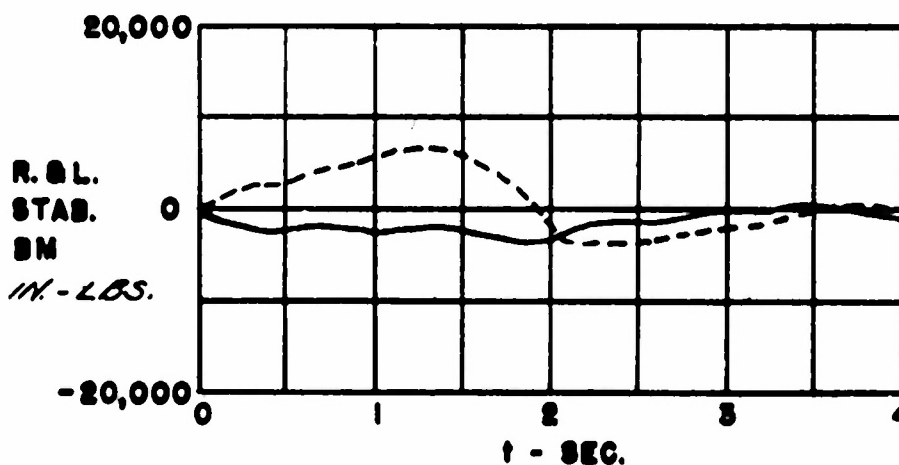
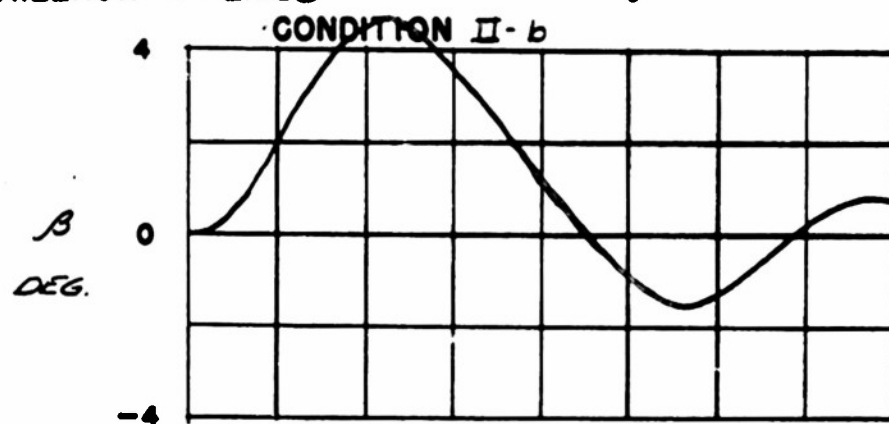


Figure 26

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .86

RUDDER  $\delta_R$  4.3°

KICK DURATION  $T_1$  1.9 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC

AILERON LOCKED

FLIGHT 34

RUN 9210

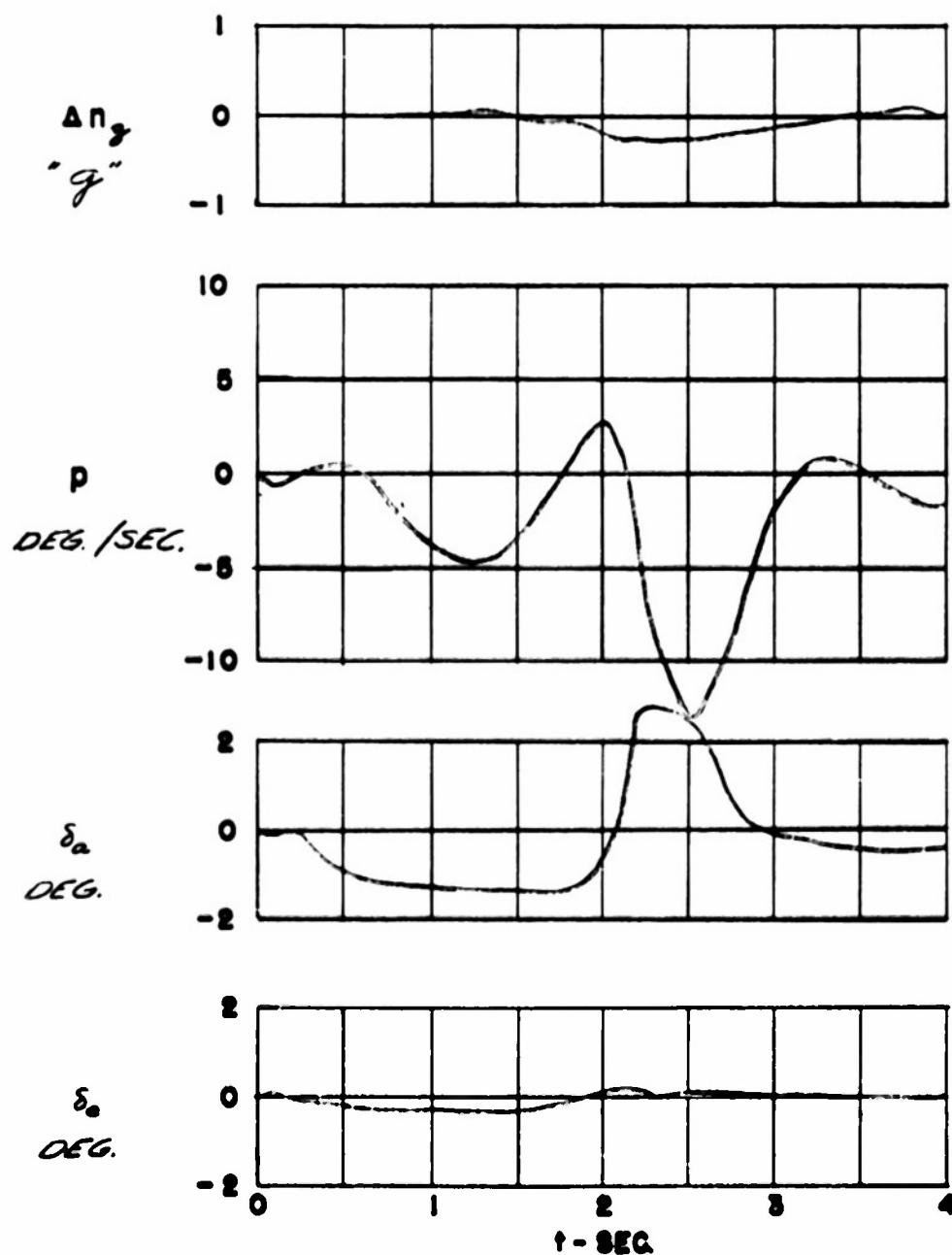
TIP TANKS OFF

ALTITUDE 20,050 FT

O.A.T. -12.5°C

$V_0$  299.8 MPH

CONDITION II-b



↑ - SEC

Figure 27

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  9.2°

KICK DURATION  $T_1$  .175 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 33

RUN 9143

TIP TANKS OFF

ALTITUDE 20,530 FT

O.A.T. -13.4 °C

$V_0$  301.2 MPH.

CONDITION II-b

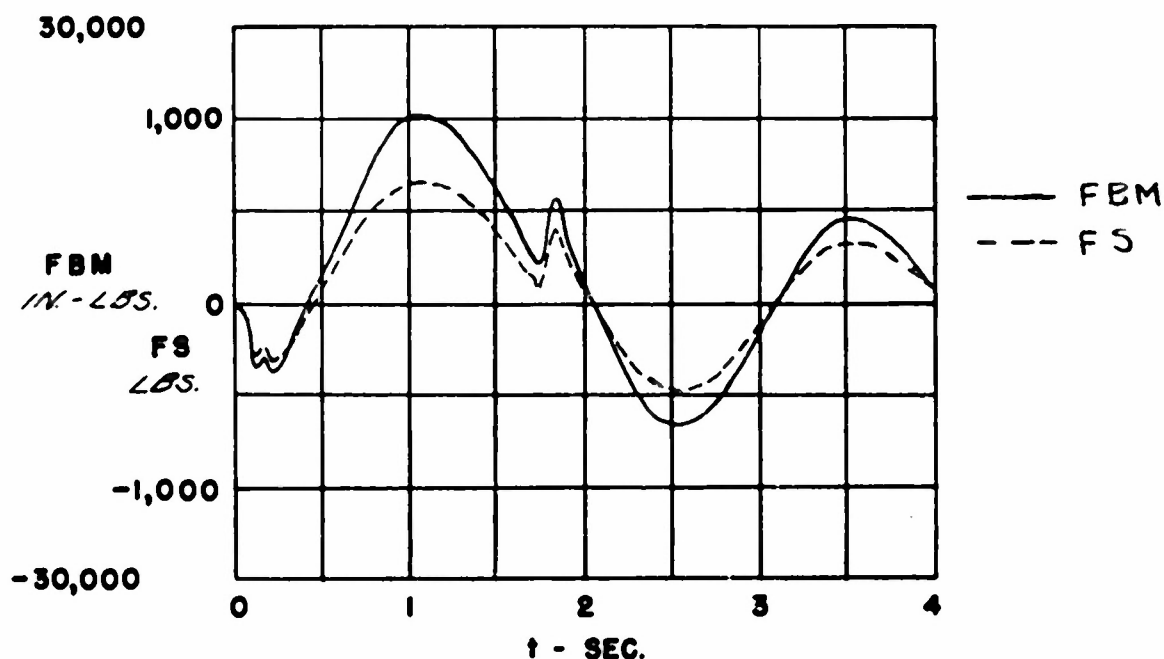
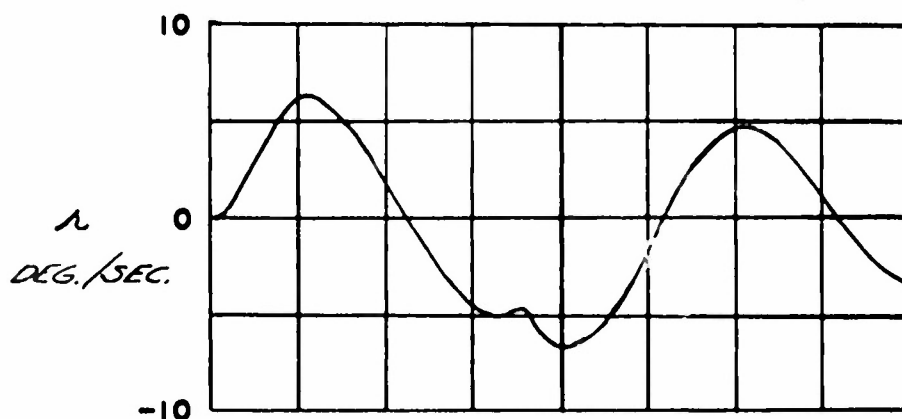
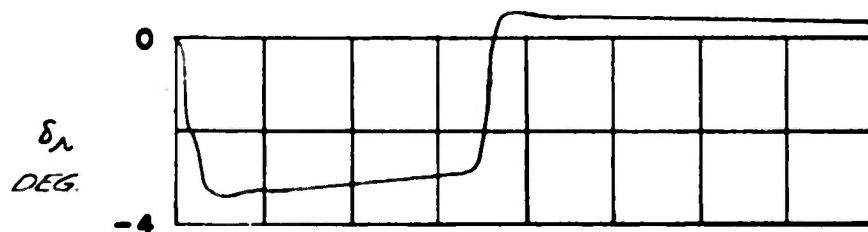


Figure 28

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 33

RUDDER  $\delta_R$  3.2°R

RUN 9143

KICK DURATION  $T_1$  1.75 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,530 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -18.4°C

AILERON LOCKED

$V_0$  301.2 MPH.

CONDITION II-b

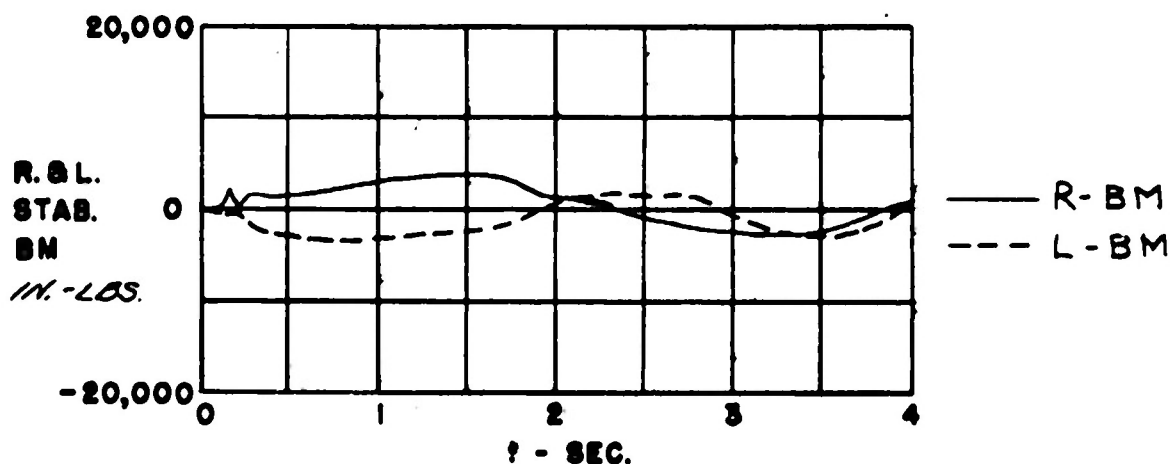
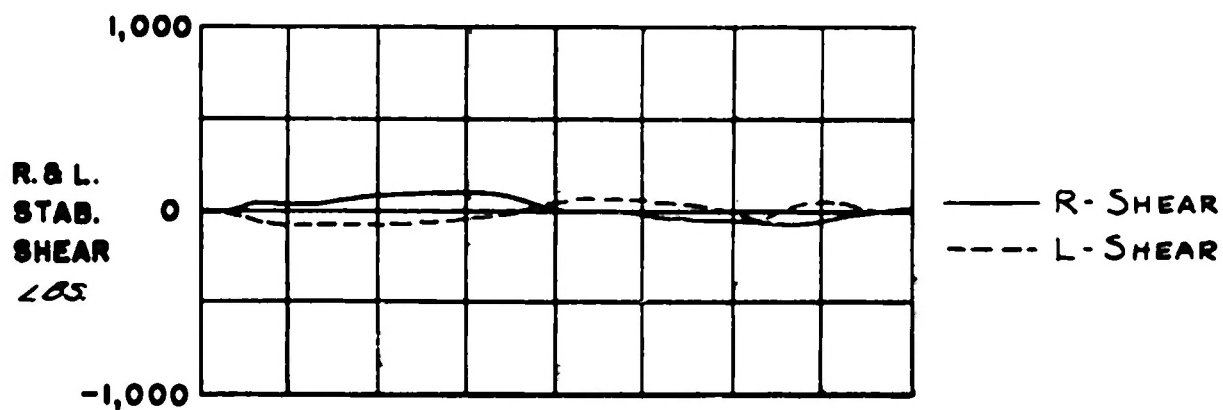
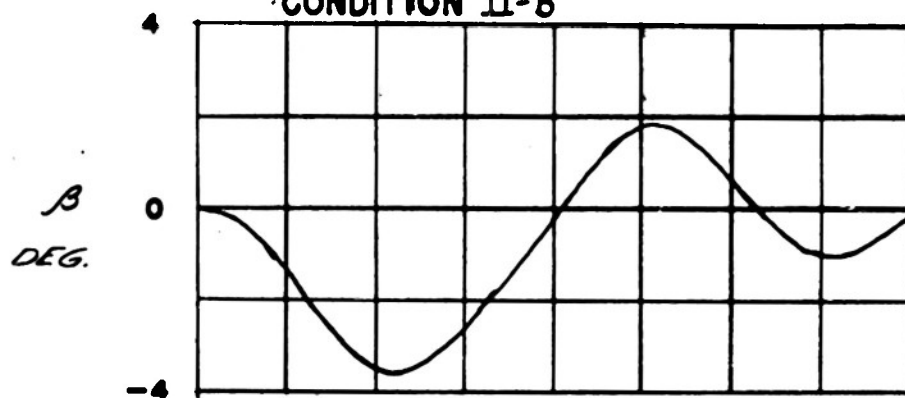


Figure 29

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 33

RUDDER  $\delta_R$  3.2° R

RUN 9143

KICK DURATION  $T_1$  1.75 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,530 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -18.4°

AILERON LOCKED

$V_0$  301.2 MPH

CONDITION II-b

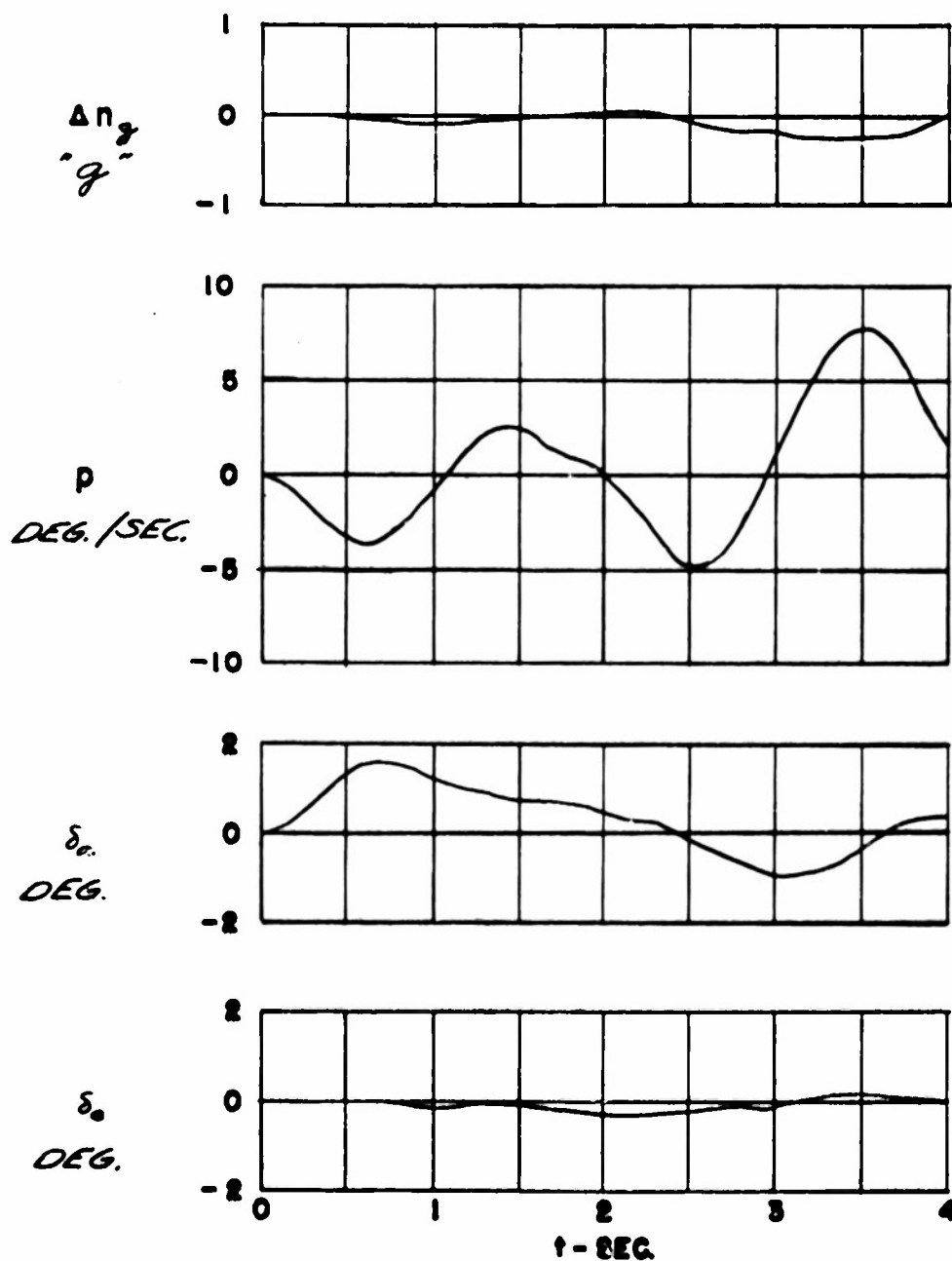


Figure 30

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 37

RUDDER  $\delta_R$  4%

RUN 9684

KICK DURATION  $T_1$  1.3 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .4 SEC.

ALTITUDE 29,125 FT.

TIME TO RETURN  $\Delta T_2$  .5 SEC.

O.A.T. -11.3°C

AILERON LOCKED

$V_0$  302 MPH

CONDITION III

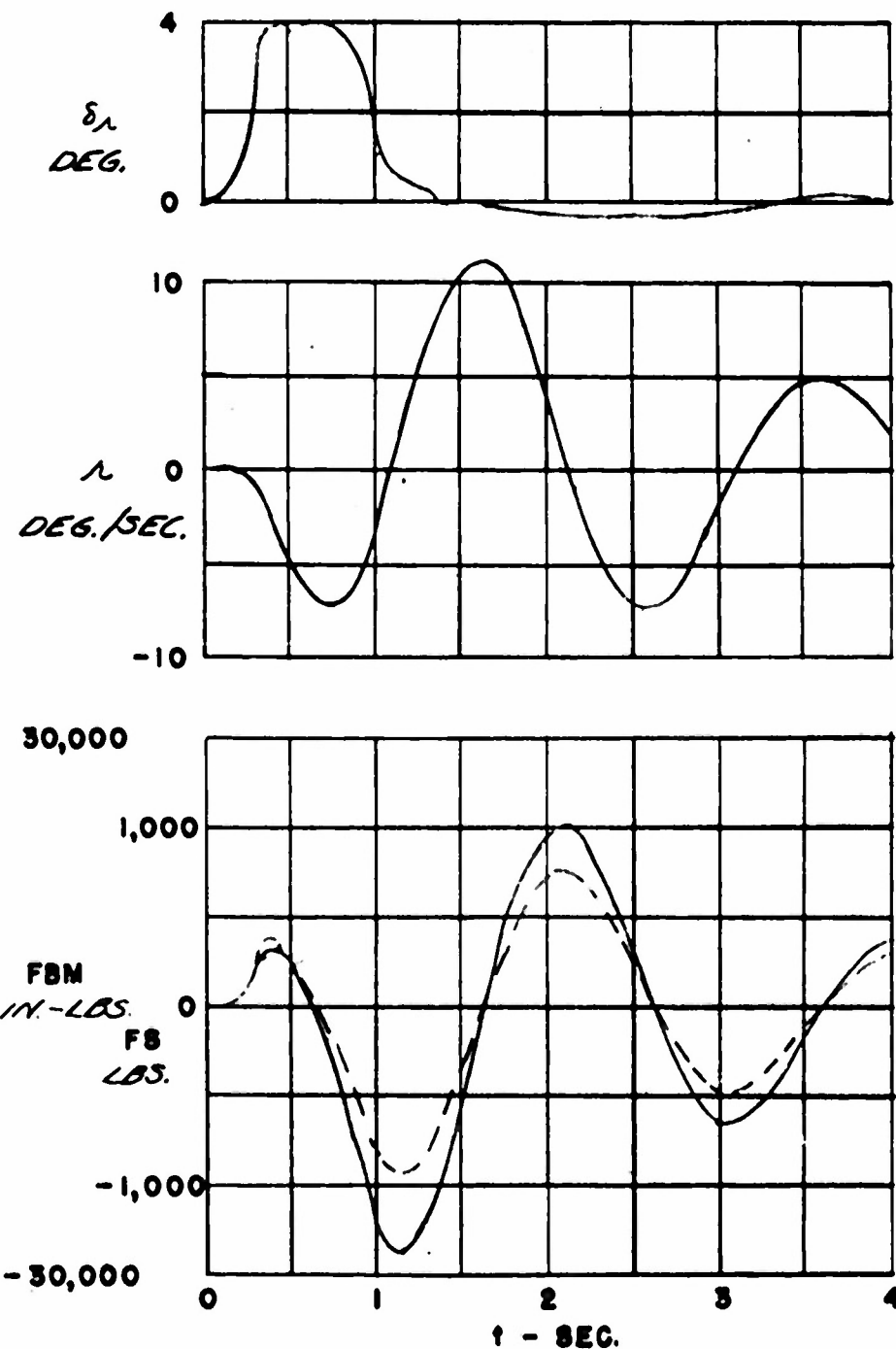


Figure 31

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 37

RUDDER  $\delta_R$  4°

RUN 9684

KICK DURATION  $T_1$  1.3 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .4 SEC.

ALTITUDE 20,125 FT.

TIME TO RETURN  $\Delta T_2$  .5 SEC.

O.A.T. -11.3 °C

AILERON LOCKED

$V_0$  308 MPH

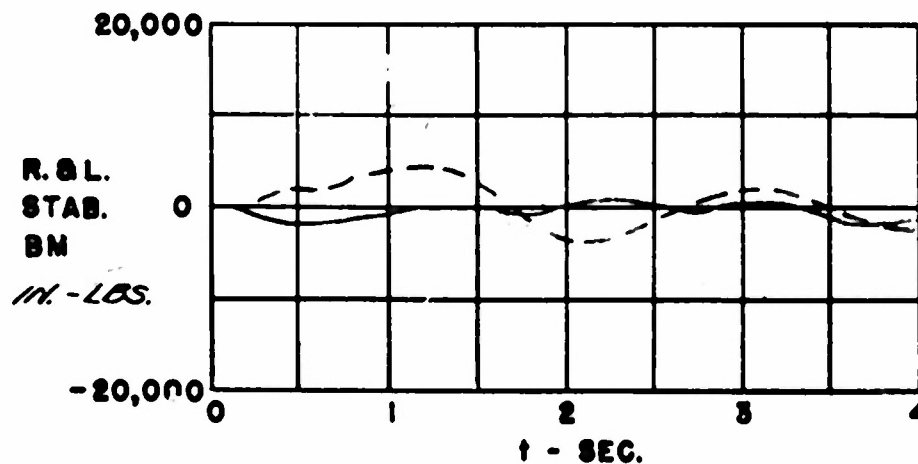
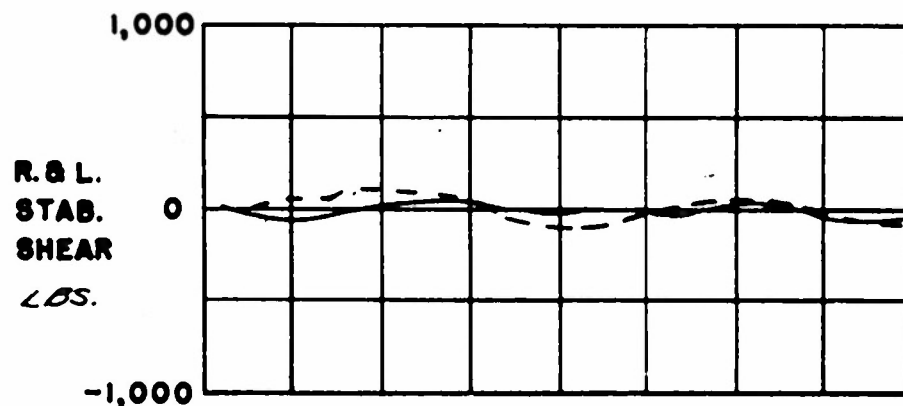
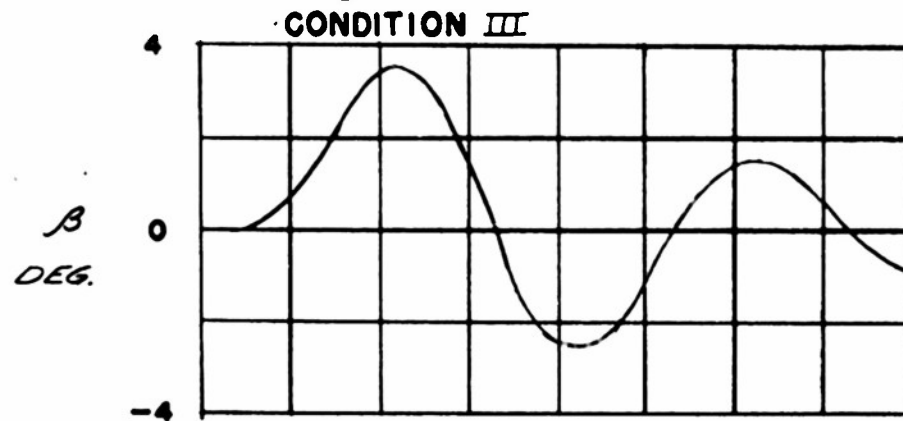


Figure 32

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 37

RUDDER  $\delta_R$  4°

RUN 9684

KICK DURATION  $T_1$  1.3 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .4 SEC.

ALTITUDE 20,125 FT.

TIME TO RETURN  $\Delta T_2$  .5 SEC.

O.A.T. -11.3°C

AILERON LOCKED

$V_0$  302 MPH

CONDITION III

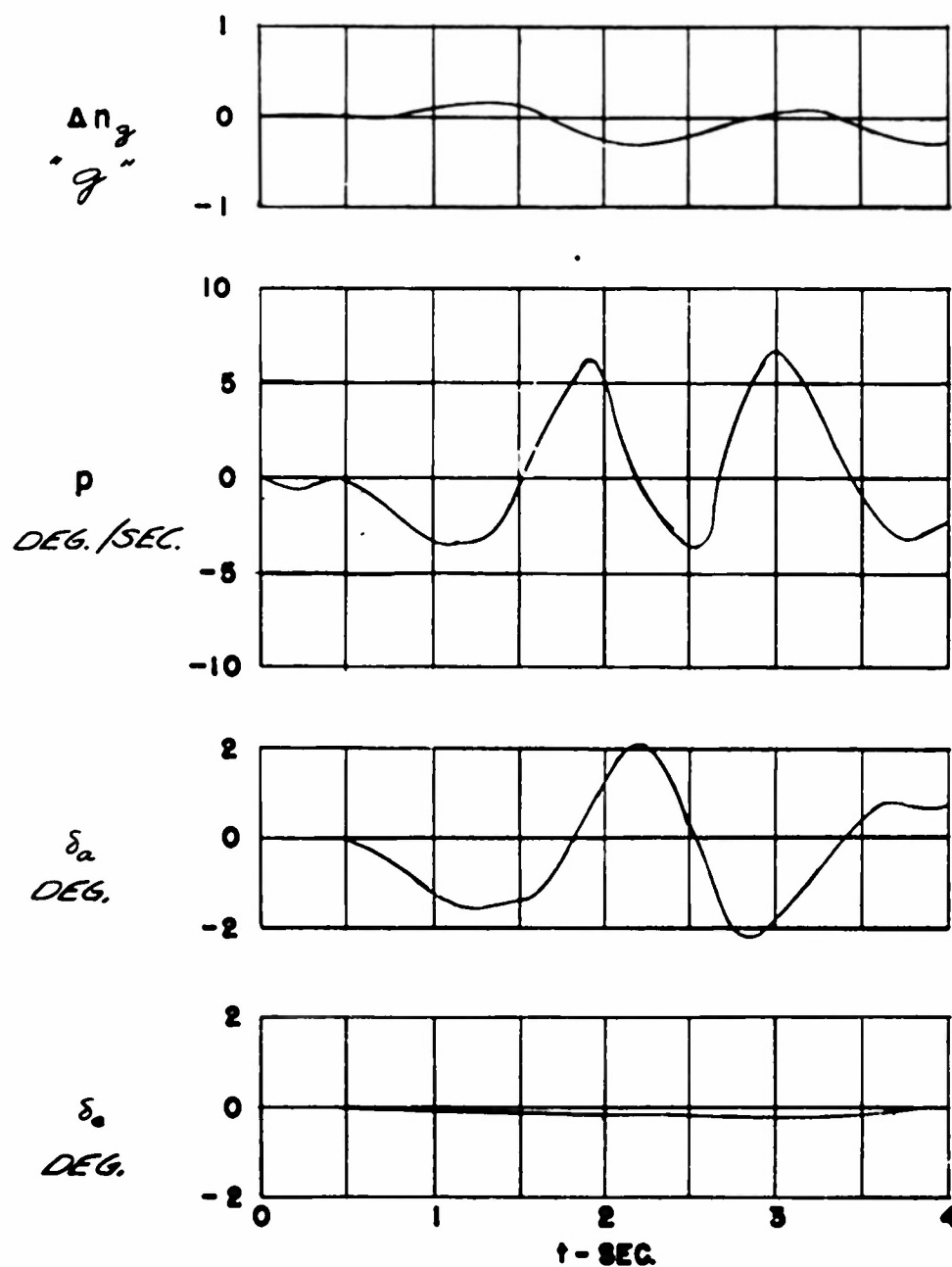


Figure 33

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 36

RUDDER  $\delta_R$  3.2°E

RUN 9424

KICK DURATION  $T_1$  10 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .3 SEC.

ALTITUDE 29 227 FT.

TIME TO RETURN  $\Delta T_2$  .5 SEC.

O.A.T. -11.5°C

AILERON LOCKED

$V_0$  301 MPH

## CONDITION III

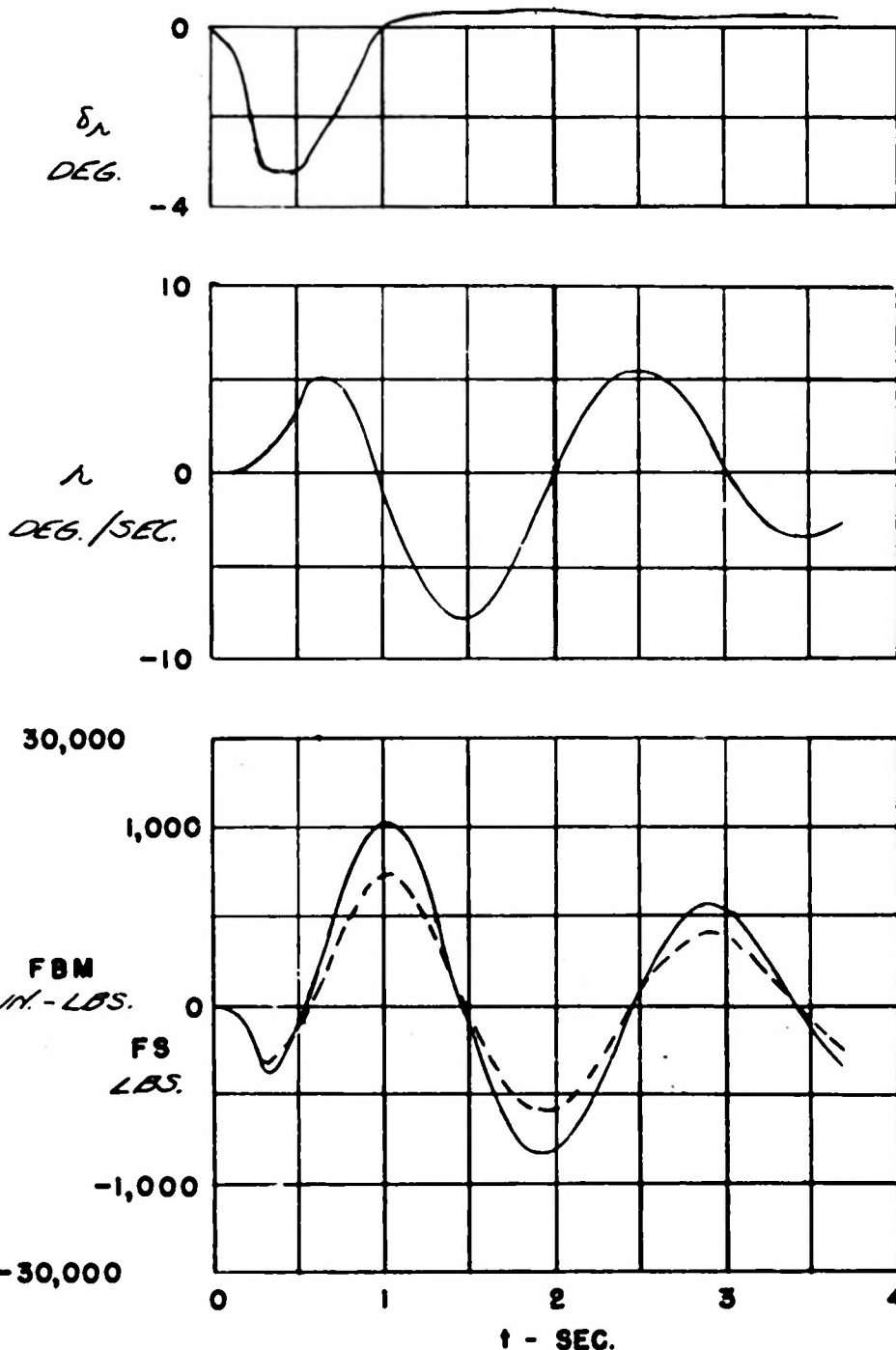


Figure 34

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_r$  3.2°

KICK DURATION  $T_1$  1.0 SEC.

TIME TO APPLY  $\Delta T_1$  .3 SEC.

TIME TO RETURN  $\Delta T_2$  .5 SEC.

AILERON LOCKED

FLIGHT 36

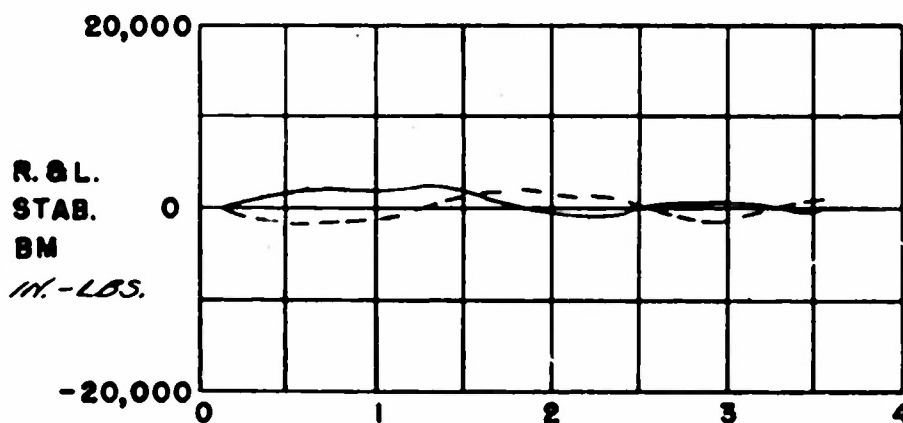
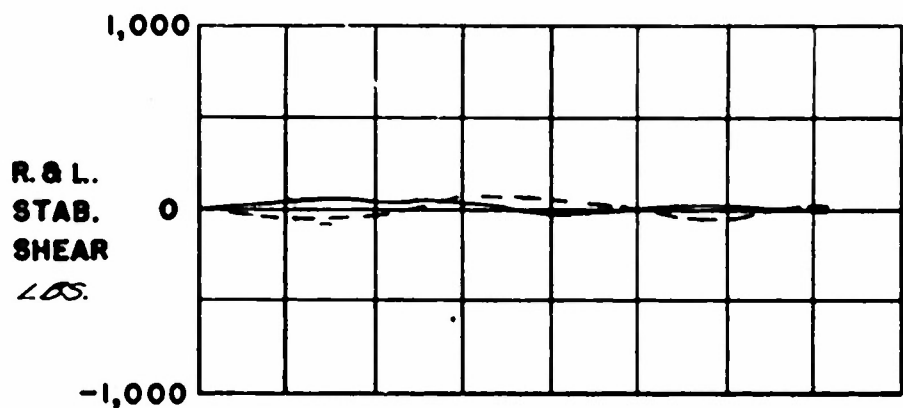
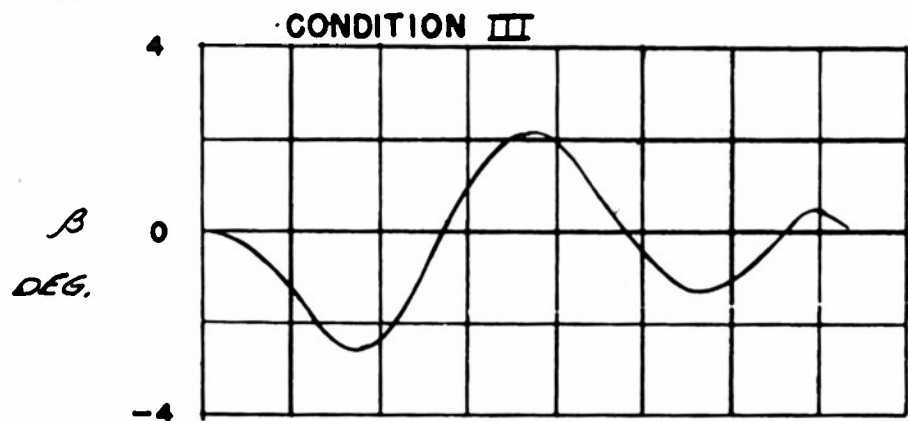
RUN 9424

TIP TANKS OFF

ALTITUDE 20,227 FT.

O.A.T. -11.5°C

$V_0$  301 MPH



t - SEC.

Figure 35

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# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  3.2°R

KICK DURATION  $T_1$  1.0 SEC.

TIME TO APPLY  $\Delta T_1$  .3 SEC.

TIME TO RETURN  $\Delta T_2$  .5 SEC.

AILERON LOCKED

FLIGHT 36

RUN 9424

TIP TANKS OFF

ALTITUDE 20,227 FT.

O.A.T. -11.5°C

$V_0$  301 MPH

## CONDITION III

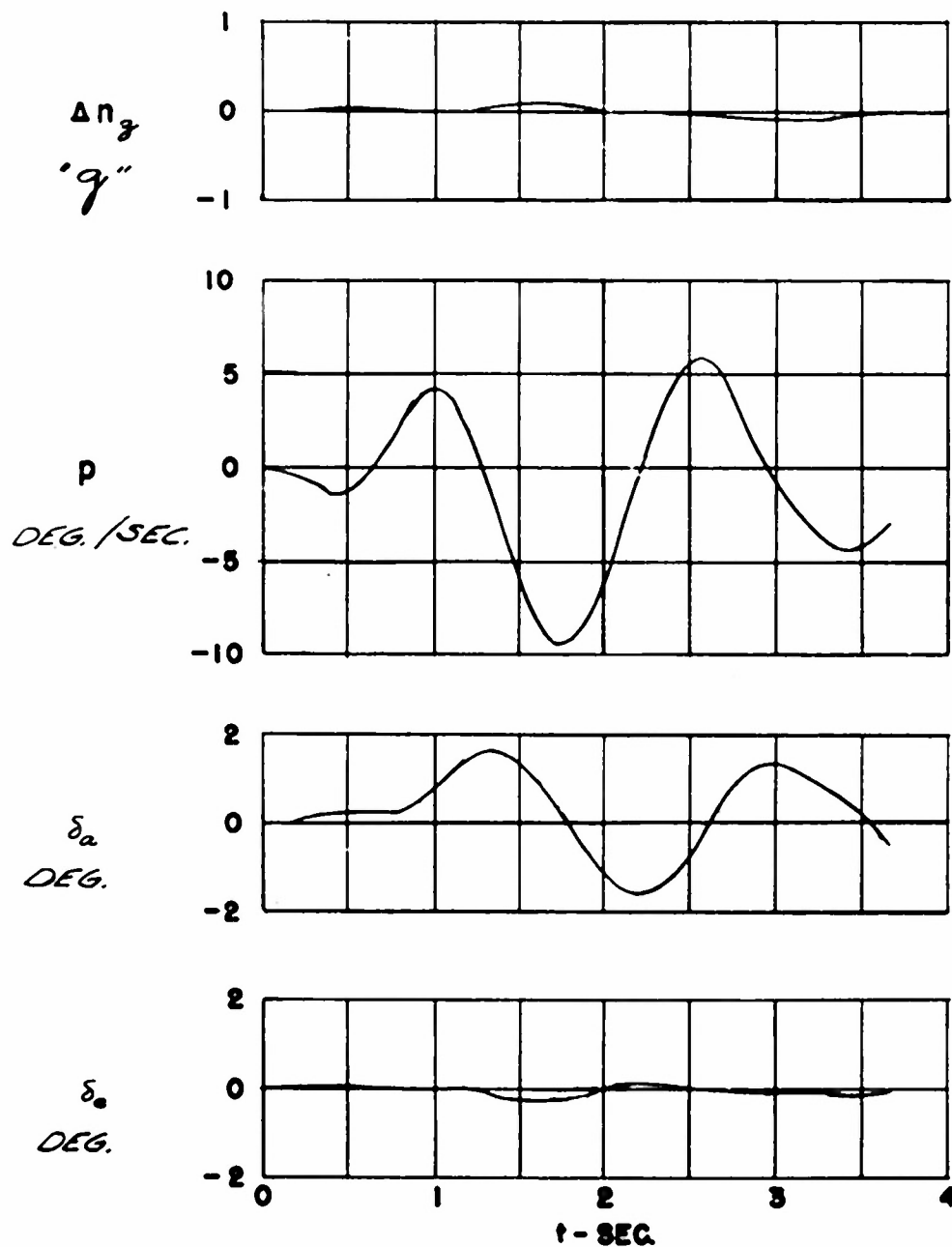


Figure 36

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 33

RUDDER  $\delta_R$  3.6°R

RUN 9147

KICK DURATION  $T_1$  1.00 SEC

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .1 SEC

ALTITUDE 20,500 FT.

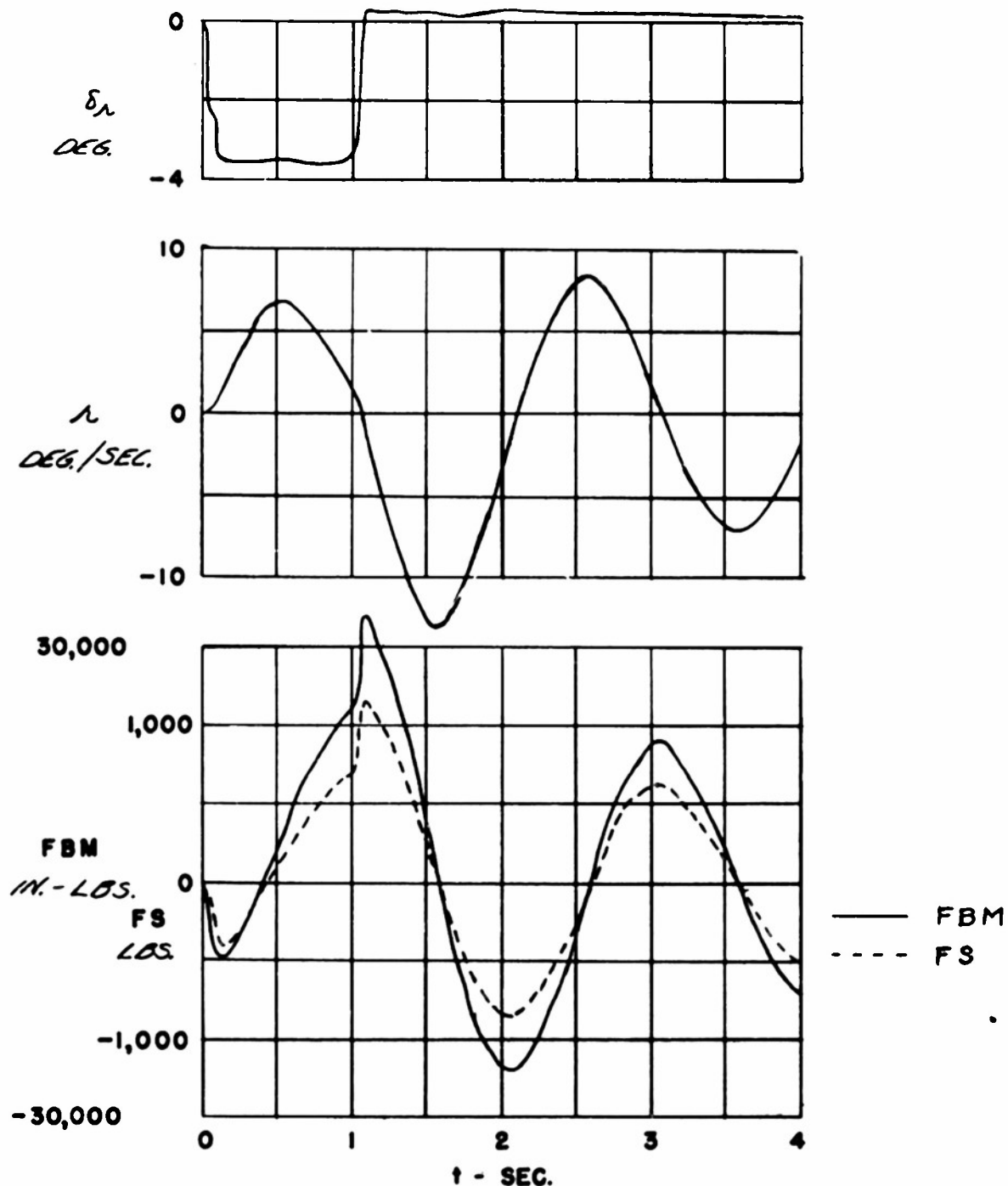
TIME TO RETURN  $\Delta T_2$  .1 SEC

O.A.T. -18.3 °C

AILERON LOCKED

$V_0$  302.6 MPH.

CONDITION III



t - SEC.

Figure 37

- 69 -

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 33

RUDDER  $\delta_R$  3.6°

RUN 9147

KICK DURATION  $T_1$  1.00 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .1 SEC.

ALTITUDE 20,500 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O. A. T. -18.3°C

AILERON LOCKED

$V_0$  302.6 MPH

CONDITION III

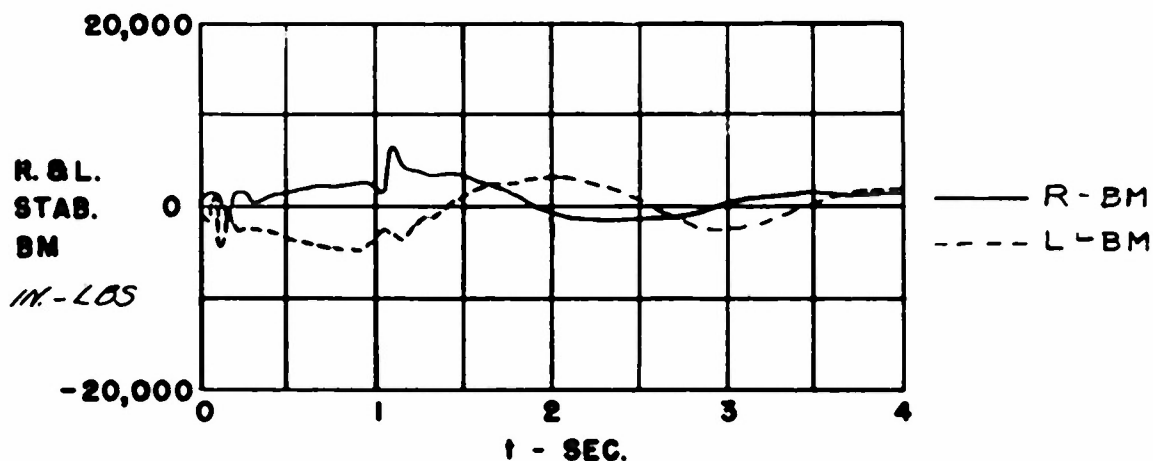
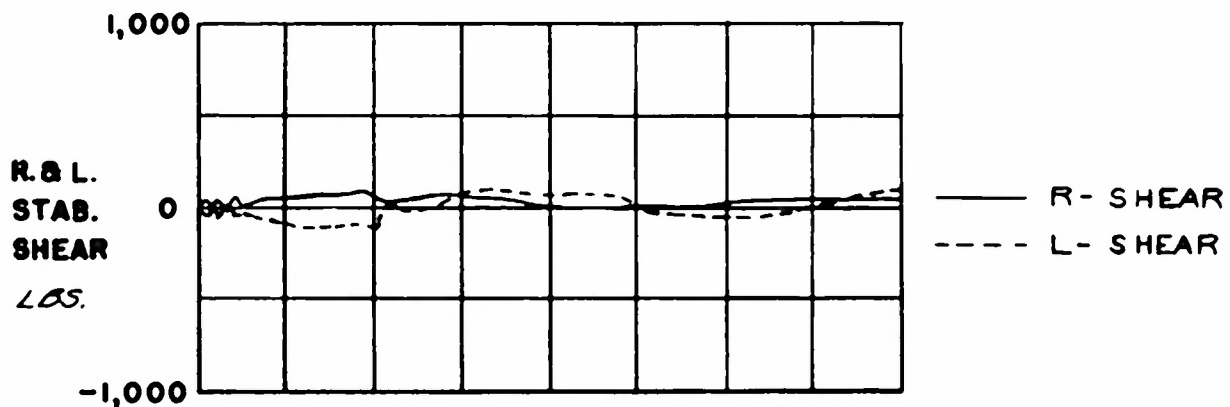
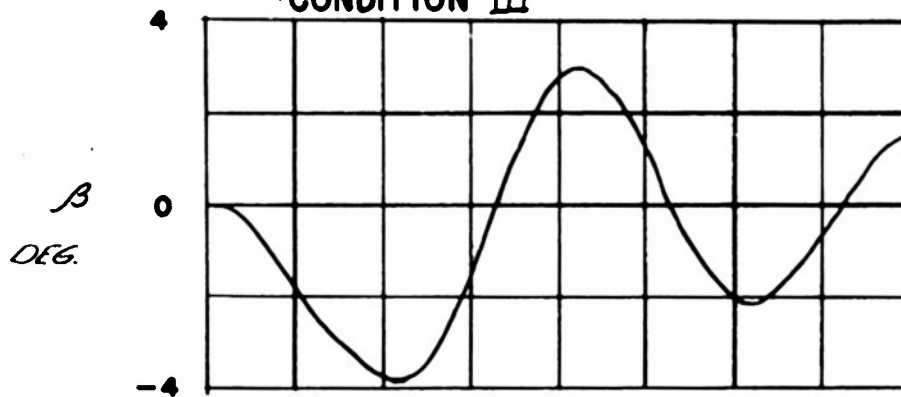


Figure 38

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  36°

KICK DURATION  $T_1$  1.00 SEC.

TIME TO APPLY  $\Delta T_1$  .1 SEC.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

AILERON LOCKED

FLIGHT 33

RUN 9147

TIP TANKS OFF

ALTITUDE 20,500 FT.

O. A. T. -18.3 °C

$V_0$  302.6 MPH

CONDITION III

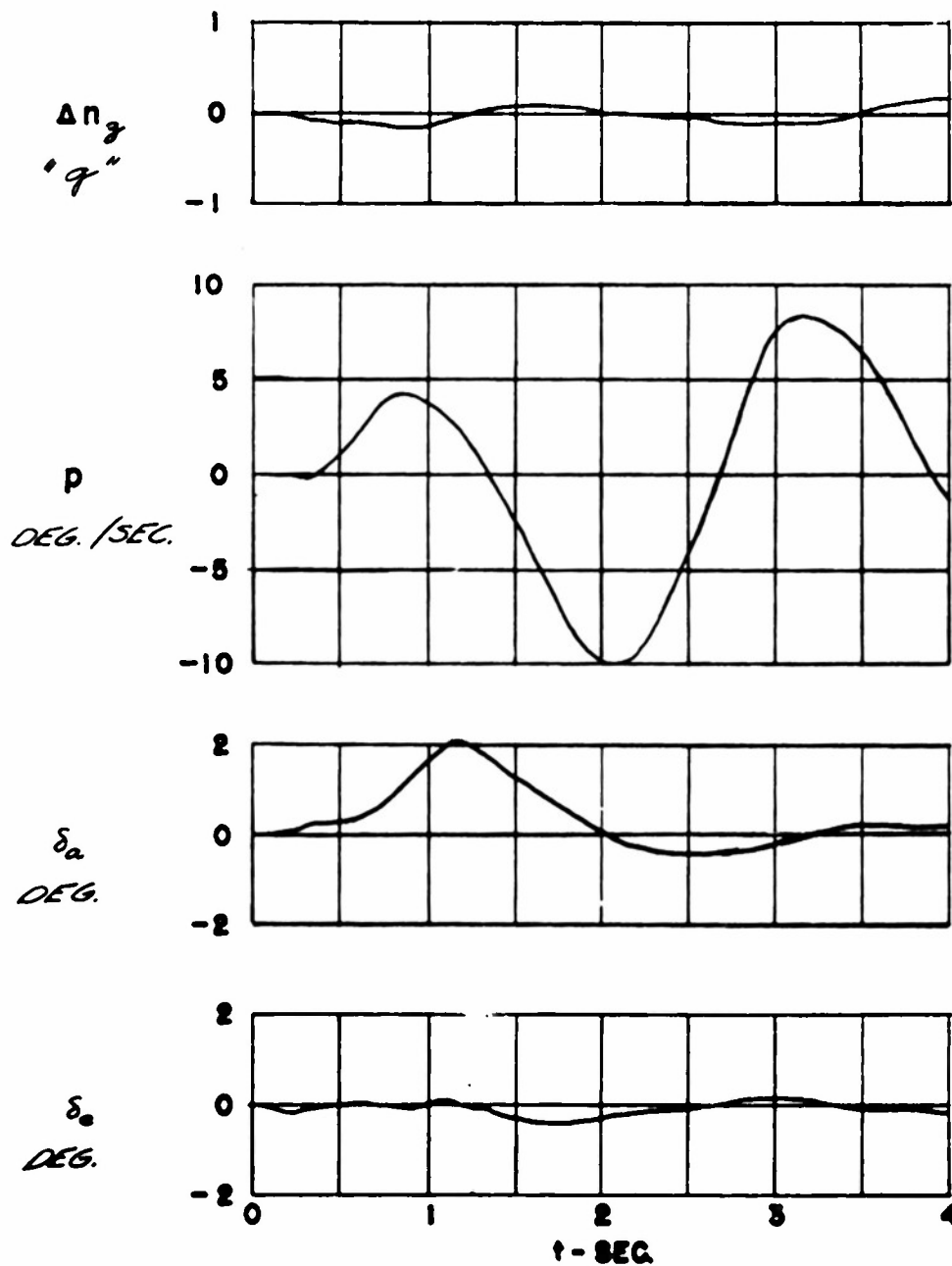


Figure 39

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .39

FLIGHT 34

RUDDER  $\delta_R$  5%

RUN 9206

KICK DURATION  $T_1$  1.5 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,084 FT.

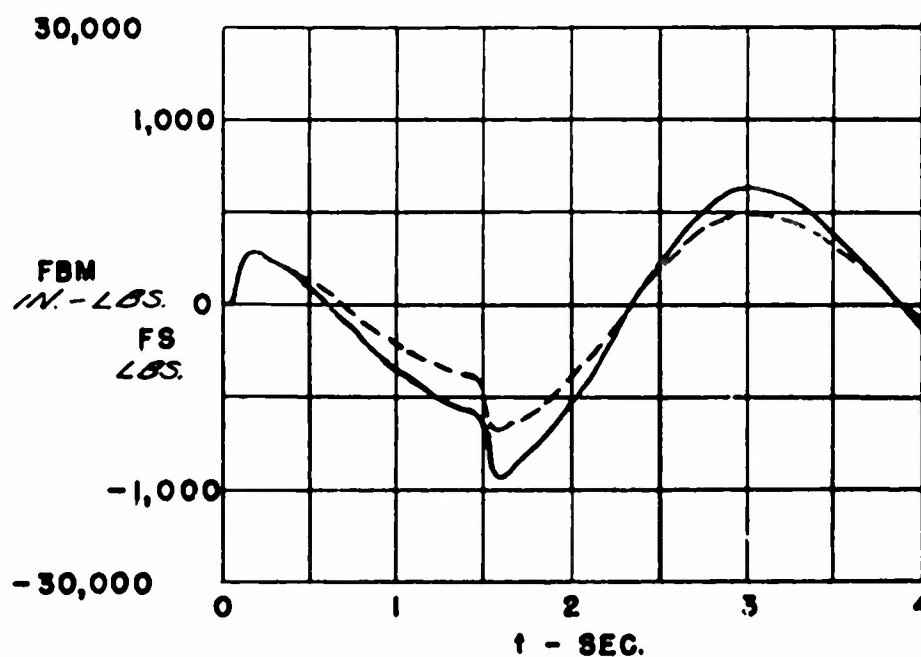
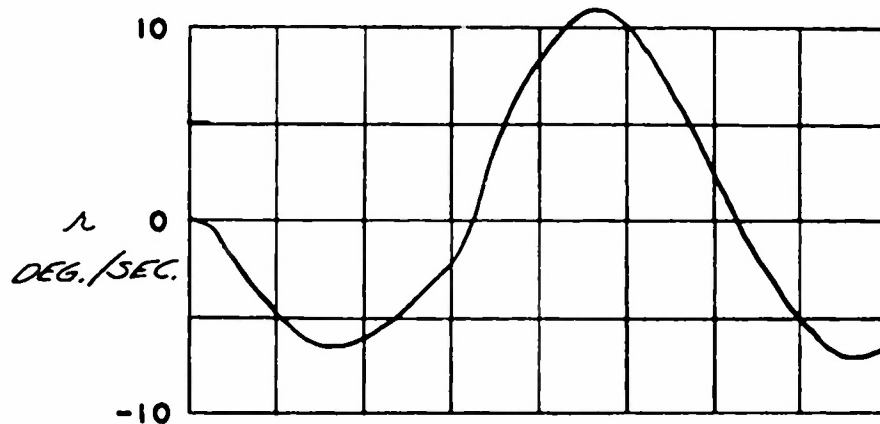
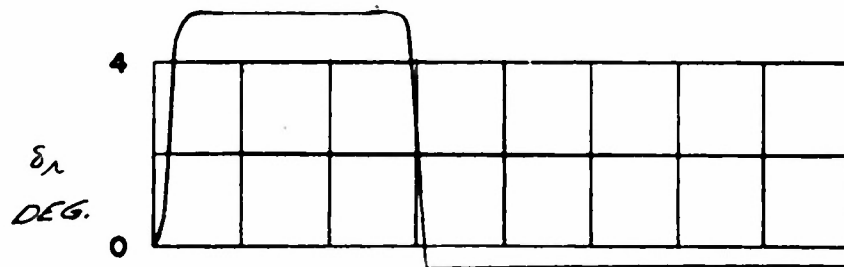
TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -14.0 °C

AILERON LOCKED

$V_0$  203.5 MPH.

CONDITION IV



— FBM  
- - - FS

t - SEC.

Figure 40

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .39

FLIGHT 34

RUDDER  $\delta_R$  5%

RUN 9206

KICK DURATION  $T_1$  1.5 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,000 FT

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -10.0 °C

AILERON LOCKED

$V_0$  203.5 MPH

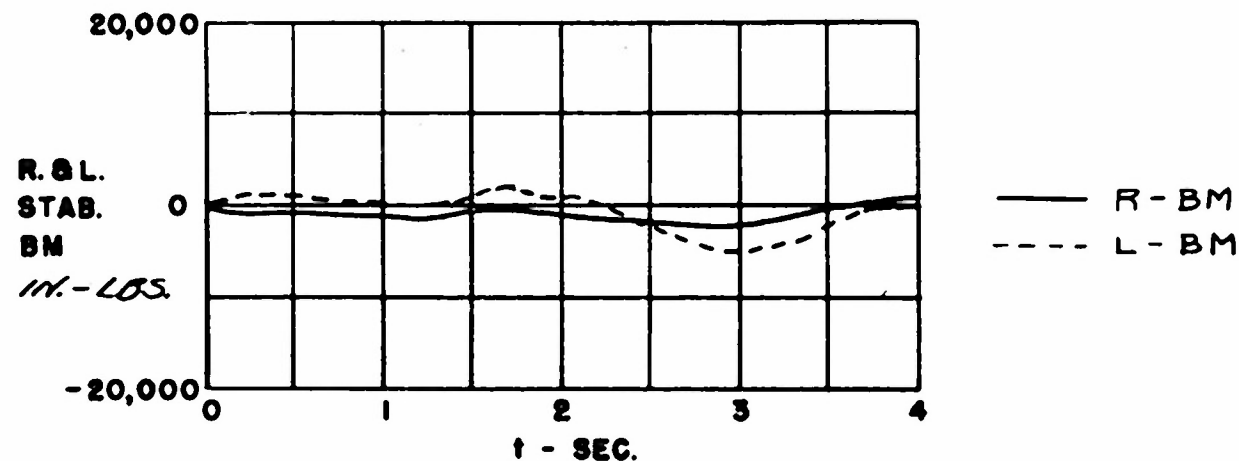
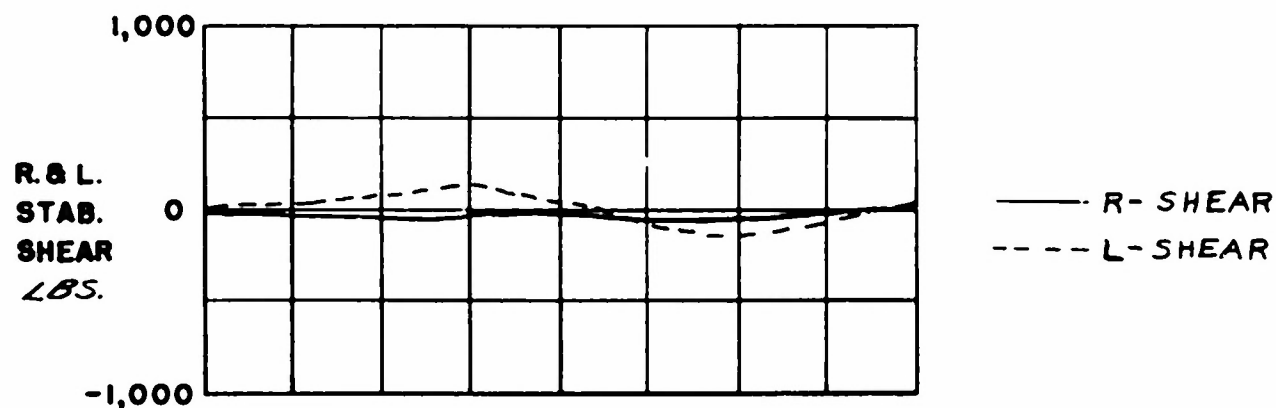
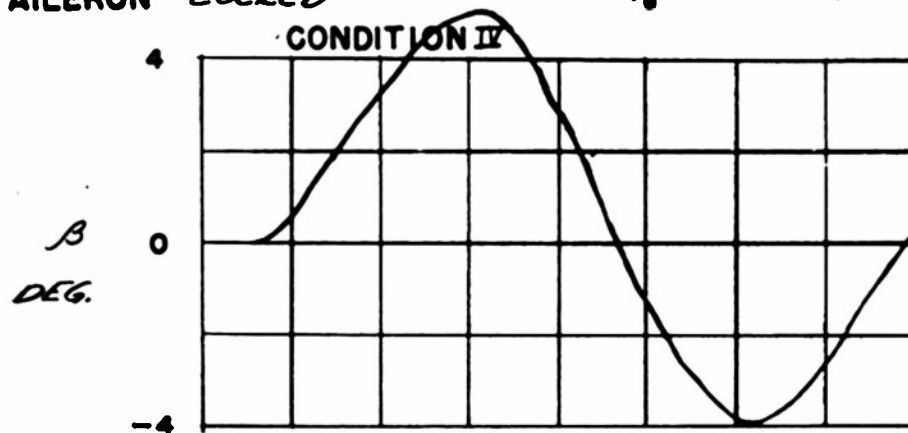


Figure 41  
- 74 -

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .89

RUDDER  $\delta_R$  5%

KICK DURATION  $T_1$  1.5 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 34

RUN 9206

TIP TANKS OFF

ALTITUDE 20,000 FT

O.A.T. -14.0 °C.

$V_0$  203.5 MPH

## CONDITION IV

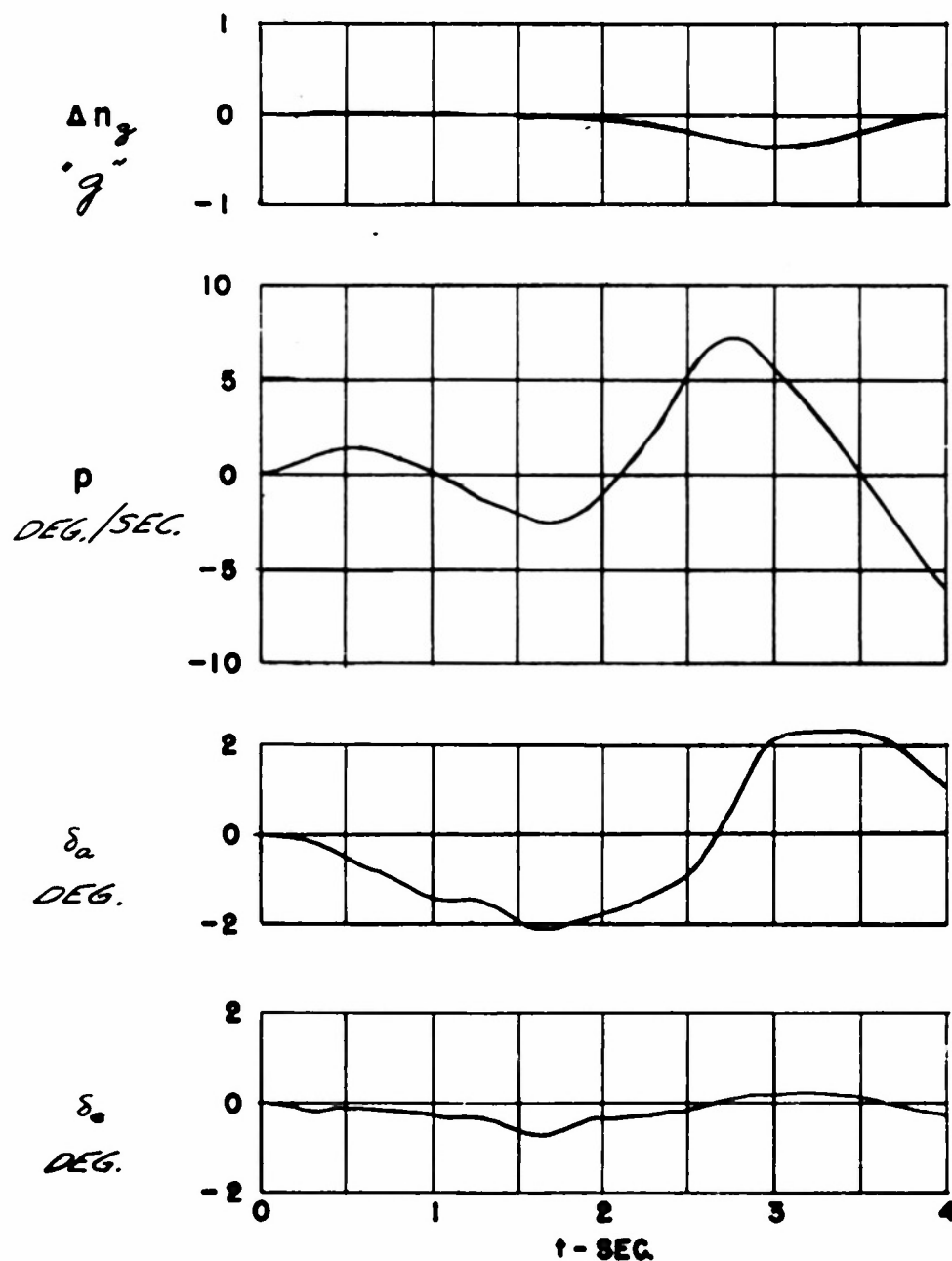


Figure 142

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .39

FLIGHT 33

RUDDER  $\delta_R$  3.8° R

RUN 9/38

KICK DURATION  $T_1$  1.5 Sec.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 Sec

ALTITUDE 20,210 FT.

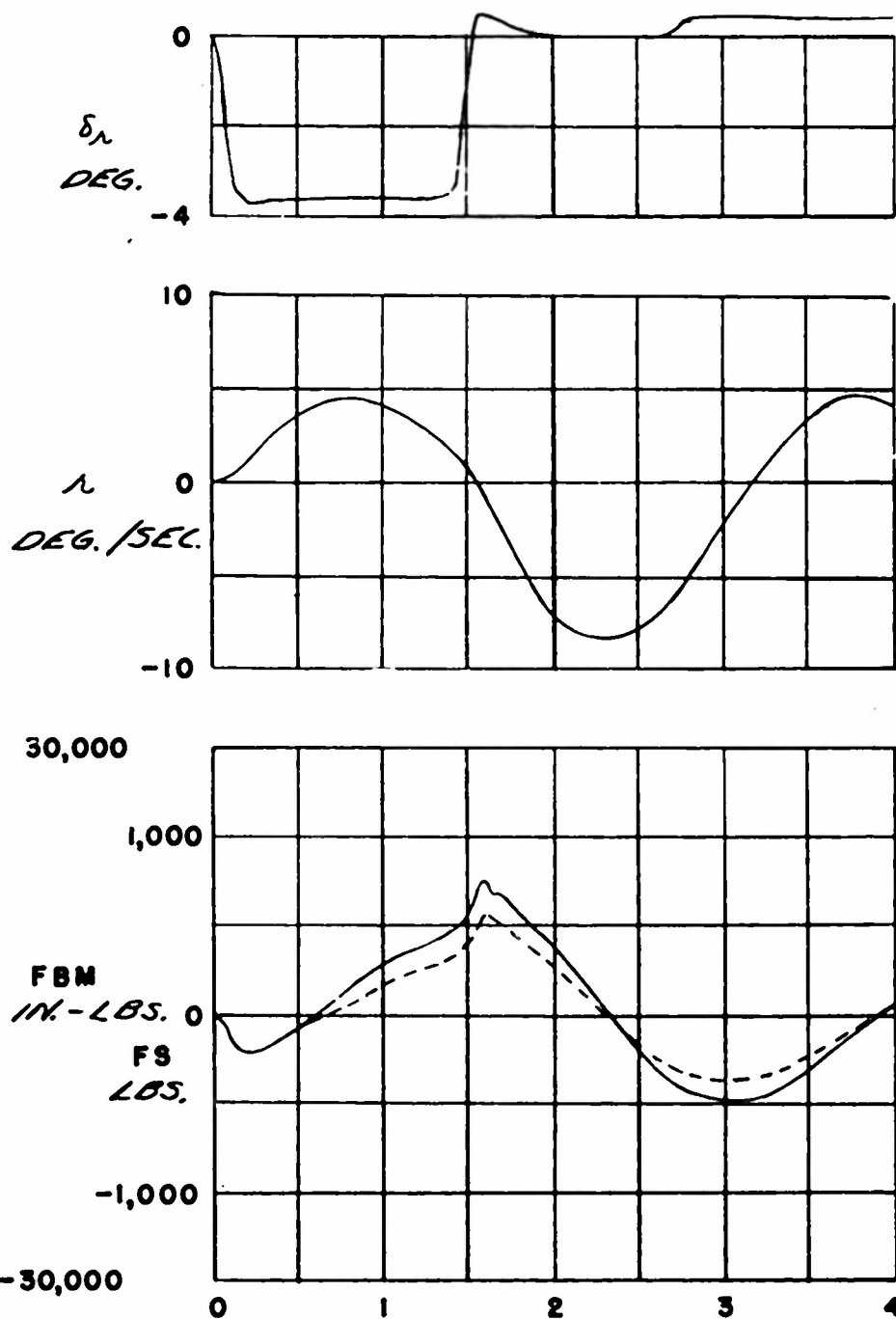
TIME TO RETURN  $\Delta T_2$  .2 Sec

O.A.T. -17.4 °C

AILERON LOCKED

$V_0$  201 MPH

CONDITION IV



t - SEC.

Figure 43

- 77 -

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .39

FLIGHT 33

RUDDER  $\delta_R$   $3.8^\circ R$

RUN 9138

KICK DURATION  $T_1$  1.5 Sec

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 Sec

ALTITUDE 20,210 FT.

TIME TO RETURN  $\Delta T_2$  .2 Sec

O.A.T.  $-17.4^\circ C$

AILERON LOCKED

$V_0$  201 MPH

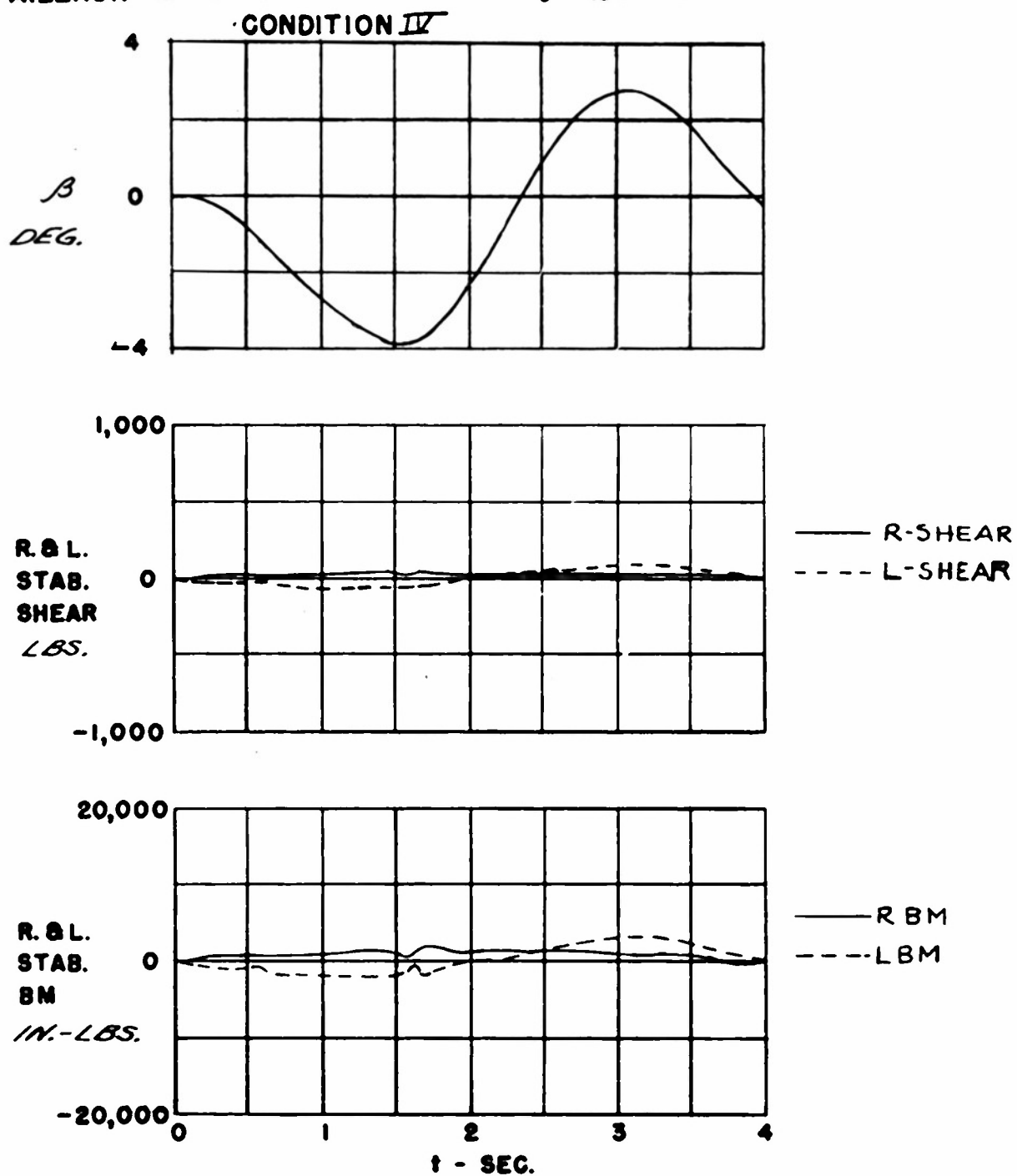


Figure 44

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .39

FLIGHT 33

RUDDER  $\delta_R$  3.8°R

RUN 9138

KICK DURATION  $T_1$  1.5 SEC

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 20,210 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC

O.A.T. -17.4°C

AILERON LOCKED

$V_0$  201 MPH

## CONDITION IV

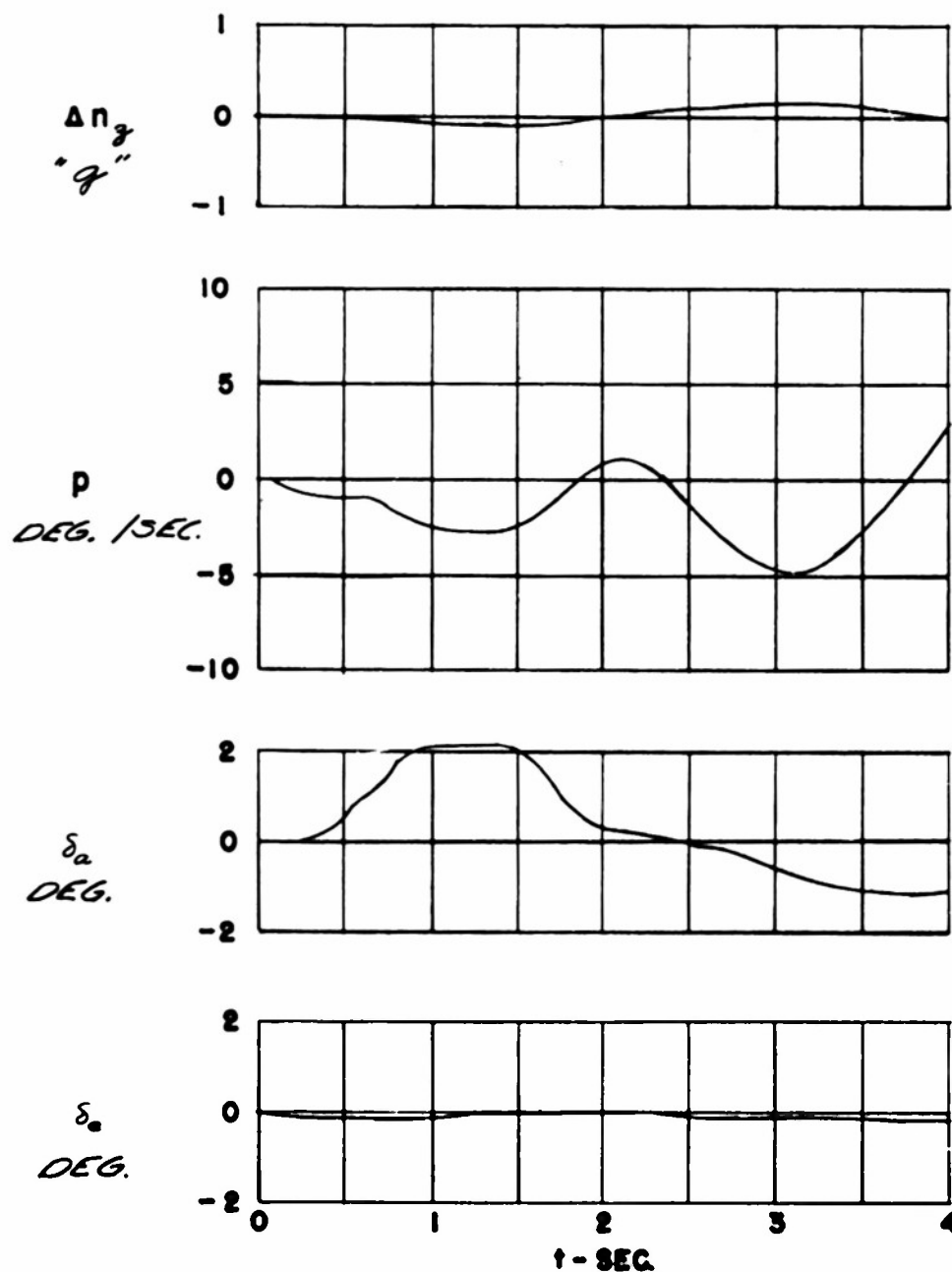


Figure 45

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

RUDDER  $\delta_R$  2.6%

KICK DURATION  $T_1$  1.1 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC

AILERON LOCKED

CONDITION V

FLIGHT 34

RUN 9220

TIP TANKS OFF

ALTITUDE 20,076 FT.

O.A.T. -13.0 °C

$V_0$  355.4 MPH

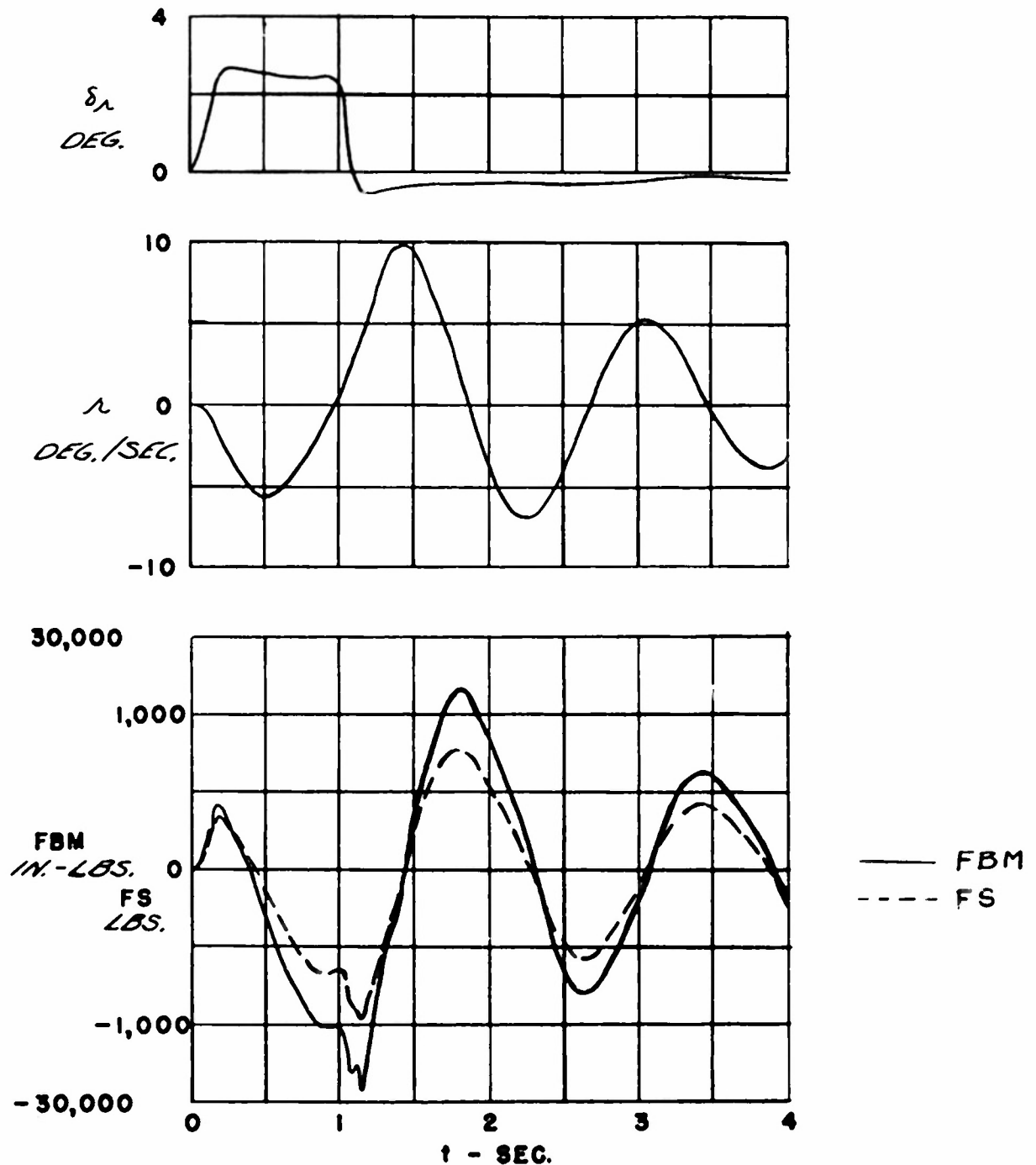


Figure 46

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

RUDDER  $\delta_R$  2.6%

KICK DURATION  $T_1$  1.1 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 34

RUN 9220

TIP TANKS OFF

ALTITUDE 20,070 FT.

O.A.T. -13.0 °C.

$V_0$  355.4 MPH

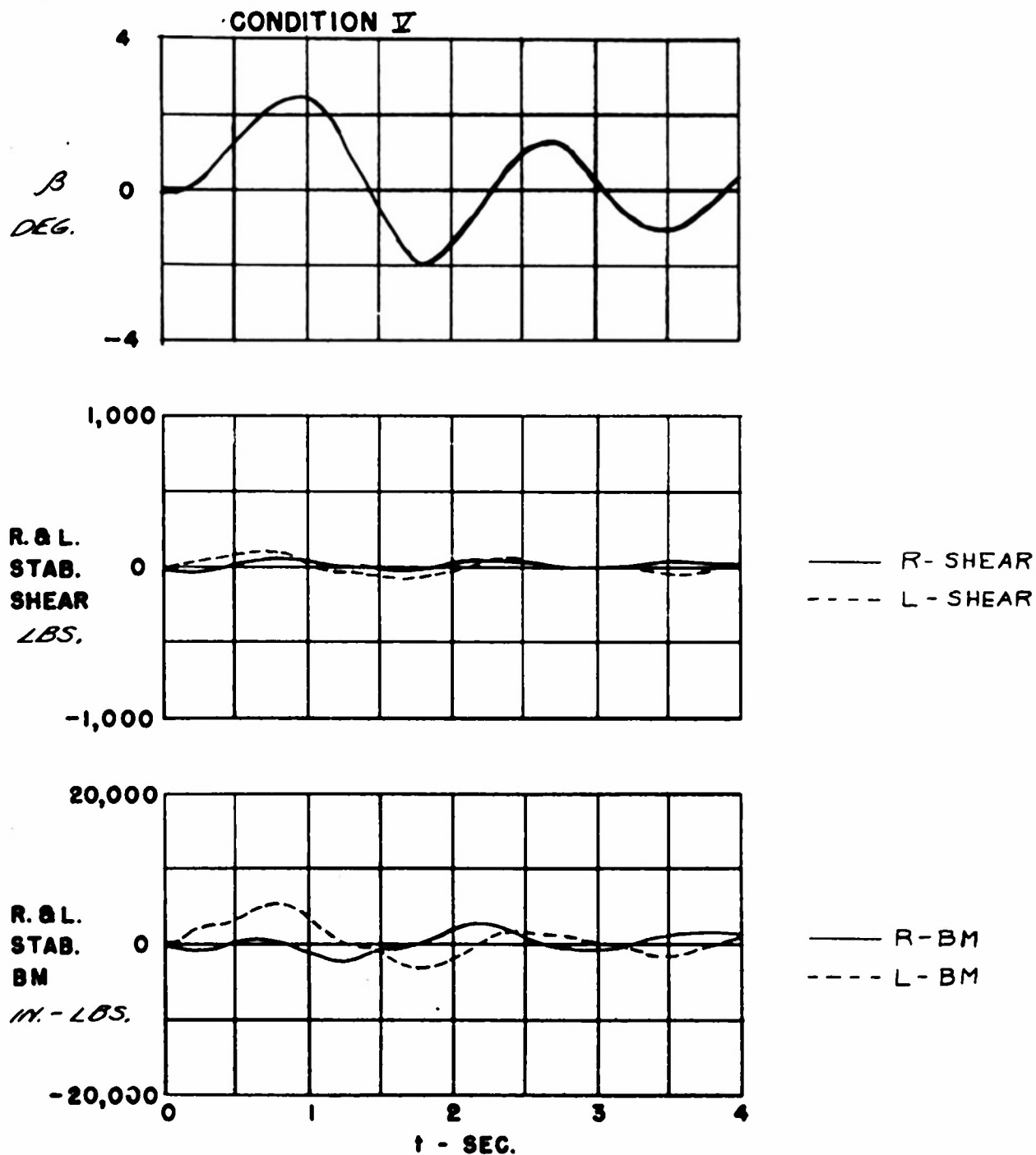


Figure 47

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

FLIGHT 34

RUDDER  $\delta_R$  2.6°

RUN 9220

KICK DURATION  $T_1$  1.1 SEC

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 30,074 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC

O. A. T. -13.0 °C

AILERON LOCKED

$V_0$  355.4 MPH

CONDITION V

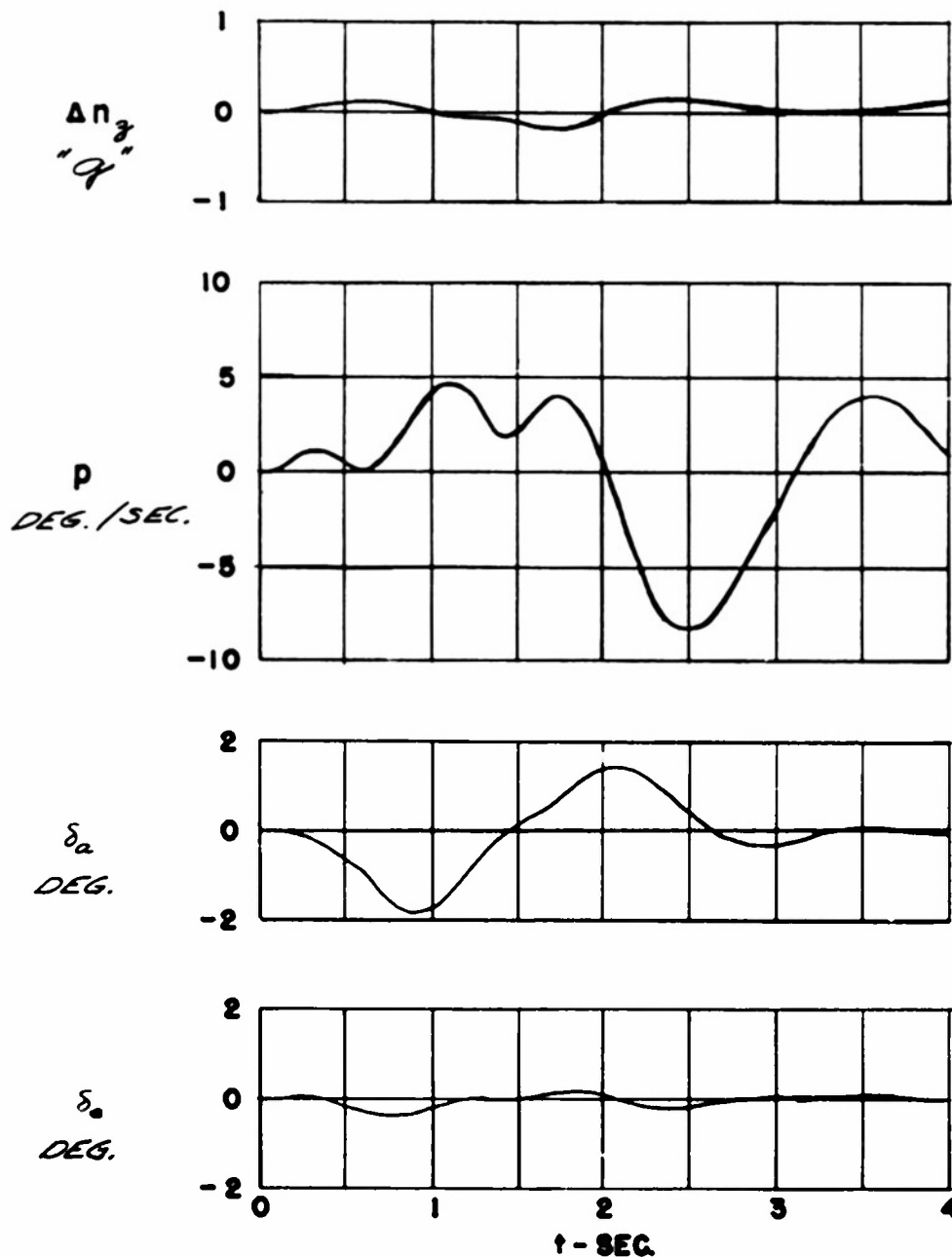


Figure 48

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

RUDDER  $\delta_R$  4.0°

KICK DURATION  $T_1$  1.0 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 35

RUN 9320

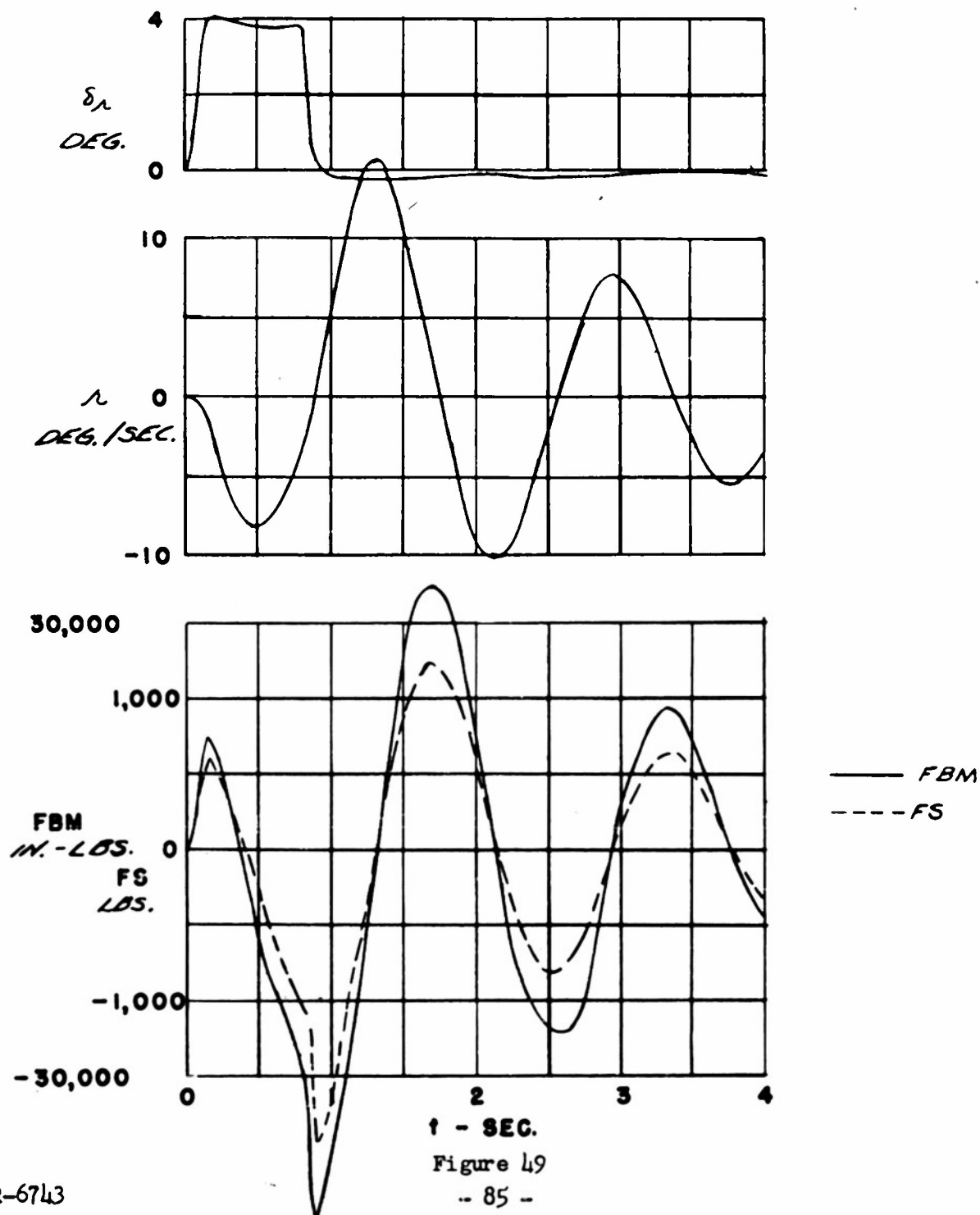
TIP TANKS OFF

ALTITUDE 20,170 FT

O.A.T. -11.4°C

$V_0$  351.2 MPH

CONDITION V



t - SEC.

Figure 49

- 85 -

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

FLIGHT 35

RUDDER  $\delta_R$  4.0%

RUN 9320

KICK DURATION  $T_1$  1.0 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 29,170 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -11.2 °C

AILERON LOCKED

$V_0$  351.4 MPH

CONDITION II

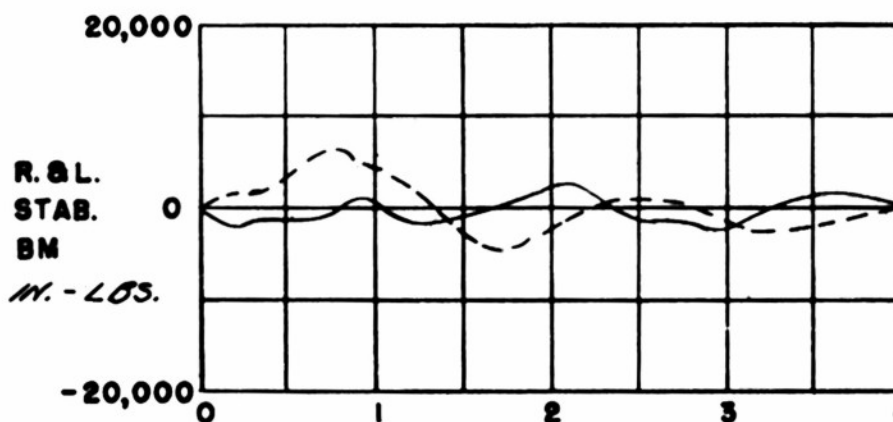
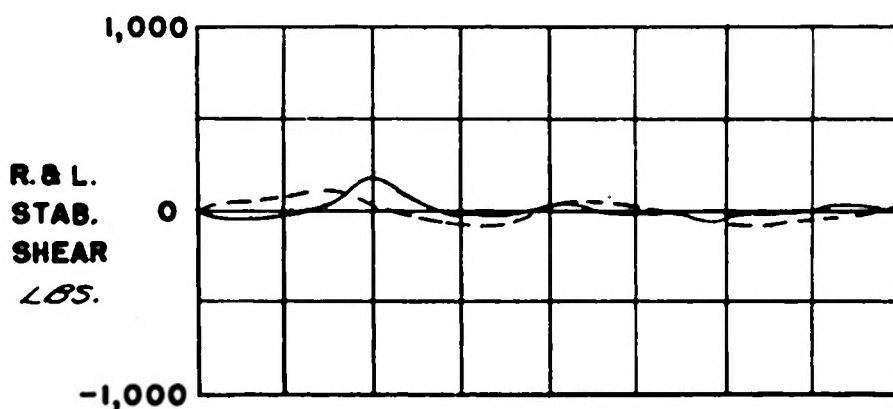
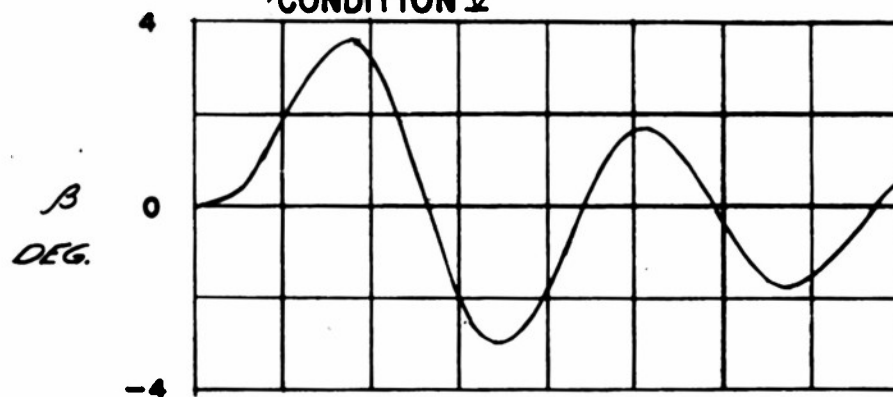


Figure 50

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

RUDDER  $\delta_R$  4.0°

KICK DURATION  $T_1$  1.0 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC

AILERON LOCKED

FLIGHT 35

RUN 9320

TIP TANKS OFF

ALTITUDE 20,170 FT.

O.A.T. -11.4 °C

$V_0$  351.4 MPH

## CONDITION V

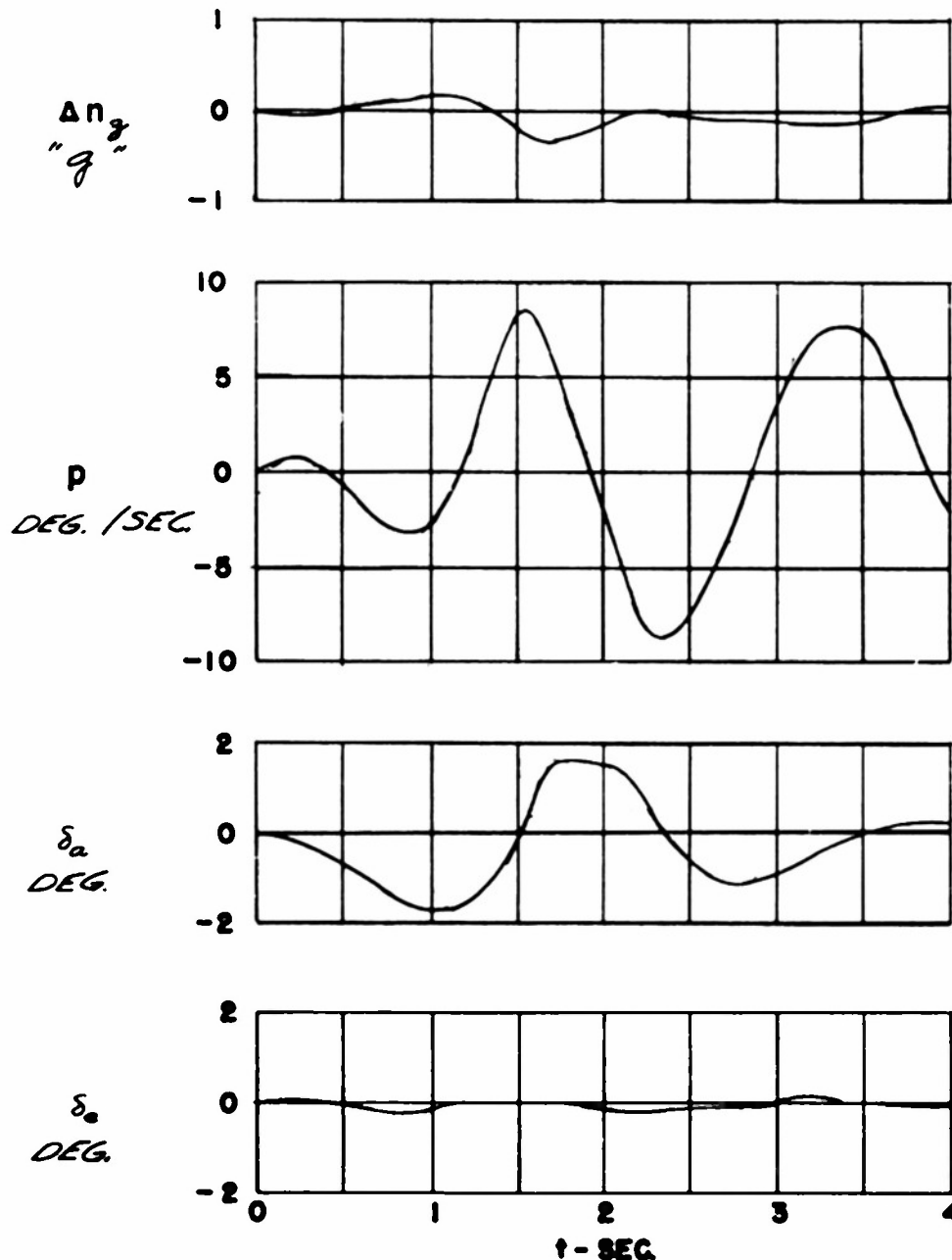


Figure 51

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

FLIGHT 33

RUDDER  $\delta_R$  2.3°R

RUN 9154

KICK DURATION  $T_1$  1.2 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,060 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -17.3°C

AILERON LOCKED

$V_0$  355.6 MPH

CONDITION V

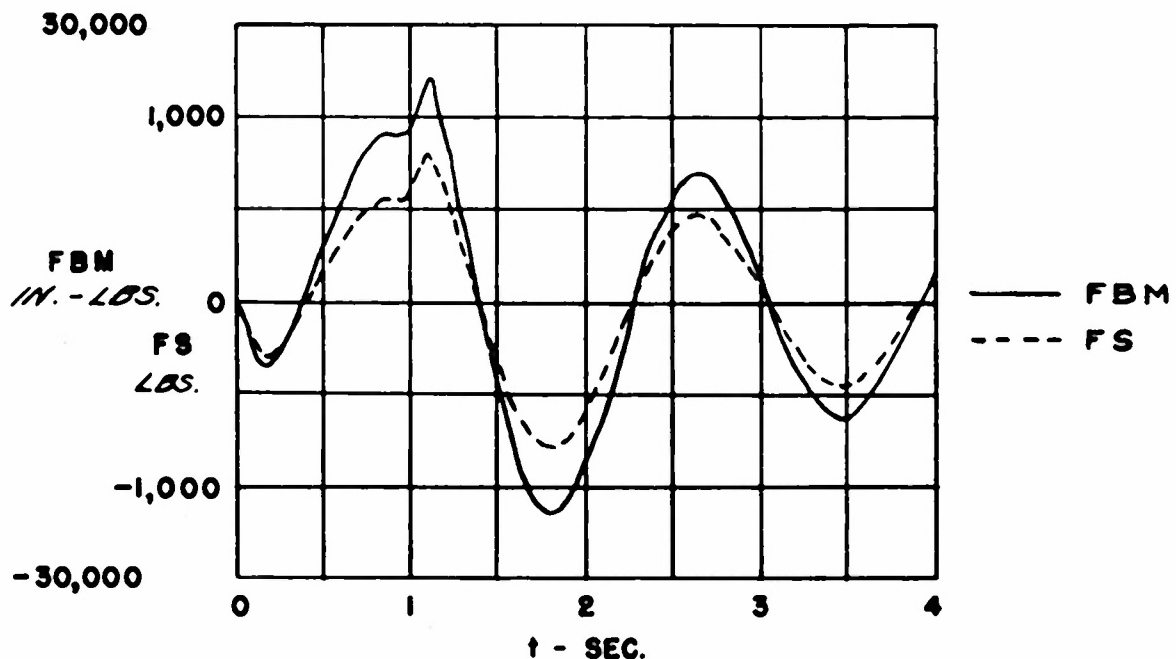
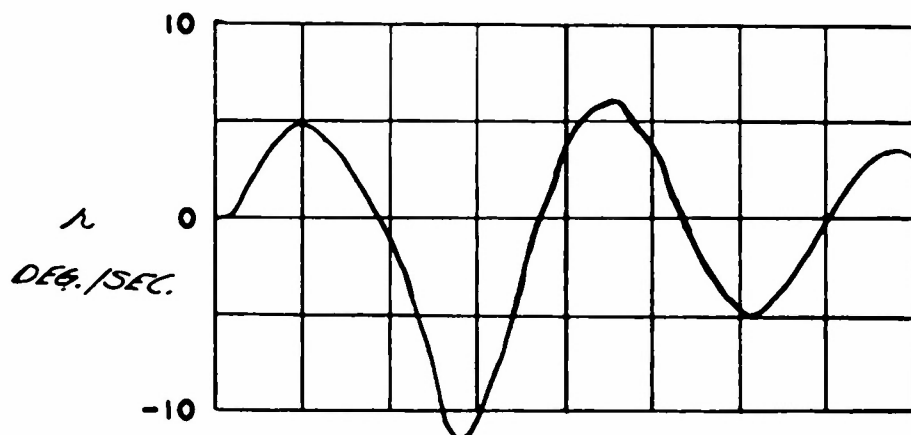
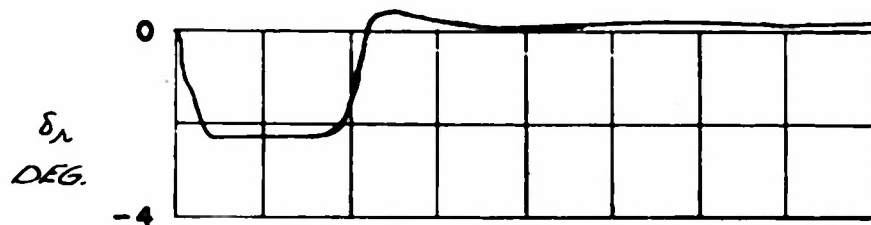


Figure 52

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

FLIGHT 33

RUDDER  $\delta_R$  2.5°

RUN 9154

KICK DURATION  $T_1$  1.2 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,060 FT

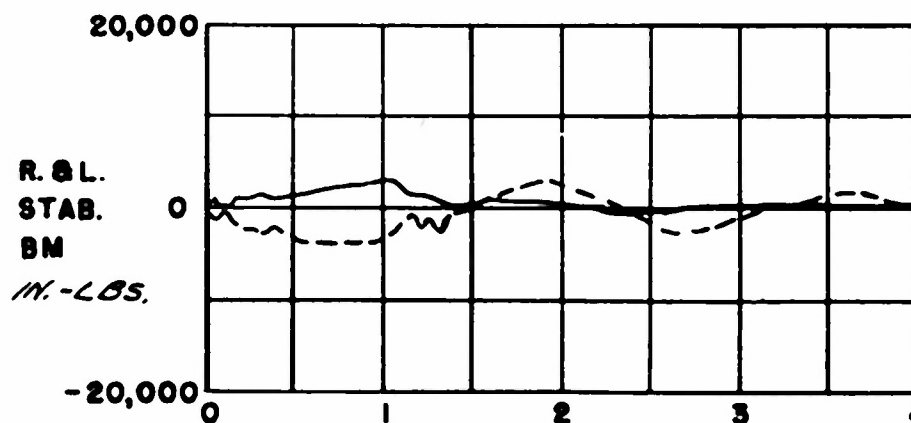
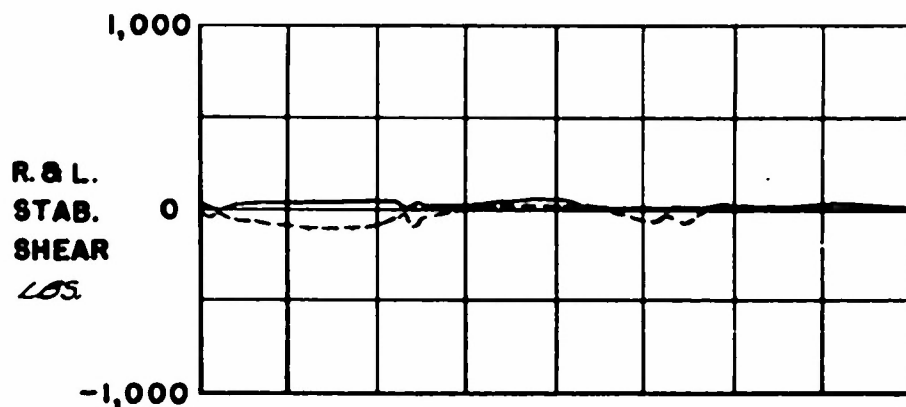
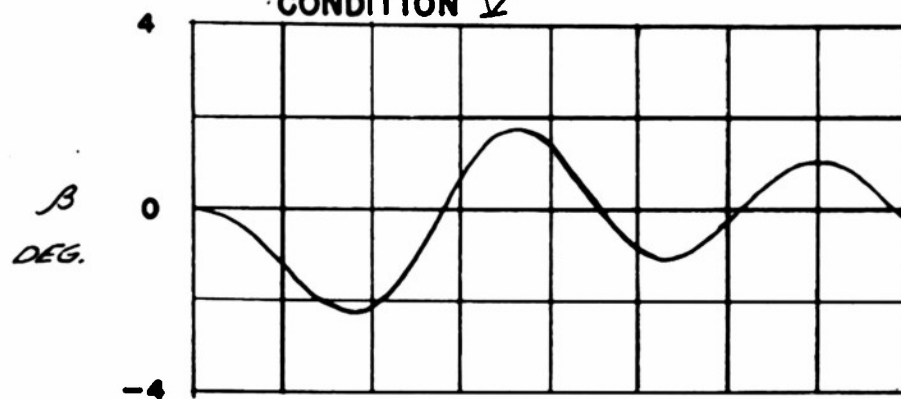
TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -17.3°C

AILERON LOCKED

$V_0$  355.6 MPH.

CONDITION V



t - SEC.

Figure 53

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

RUDDER  $\delta_R$  2.3°R

KICK DURATION  $T_1$  1.2 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 33

RUN 9154

TIP TANKS OFF

ALTITUDE 29,060 FT.

O.A.T. -17.3 °C

$V_0$  355.6 MPH

## CONDITION V

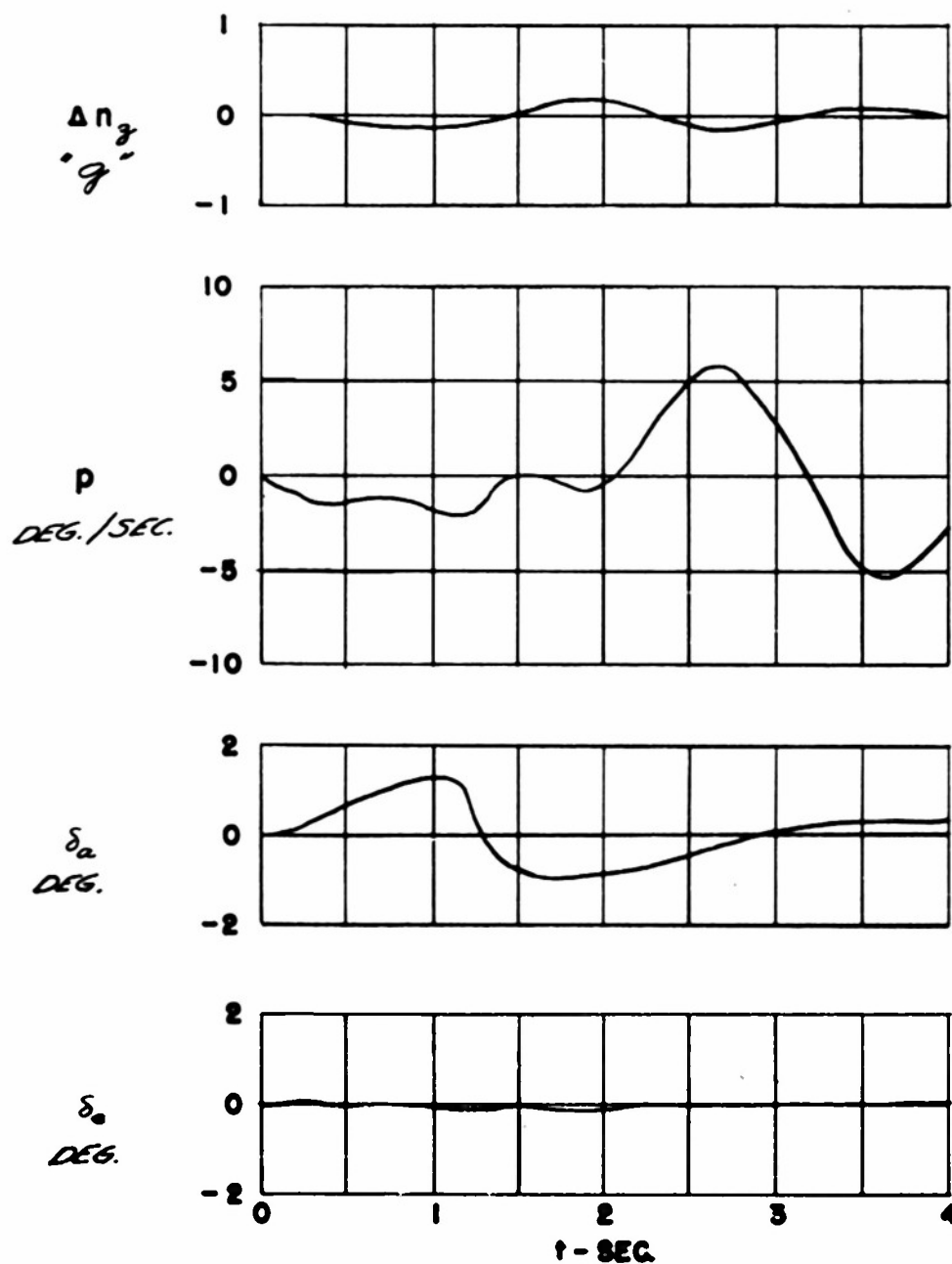


Figure 54

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

FLIGHT 35

RUDDER  $\delta_R$  3.2°

RUN 9313

KICK DURATION  $T_1$  .9 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,010 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O.A.T. -11.6 °C

AILERON LOCKED

$V_0$  357.7 MPH.

CONDITION V

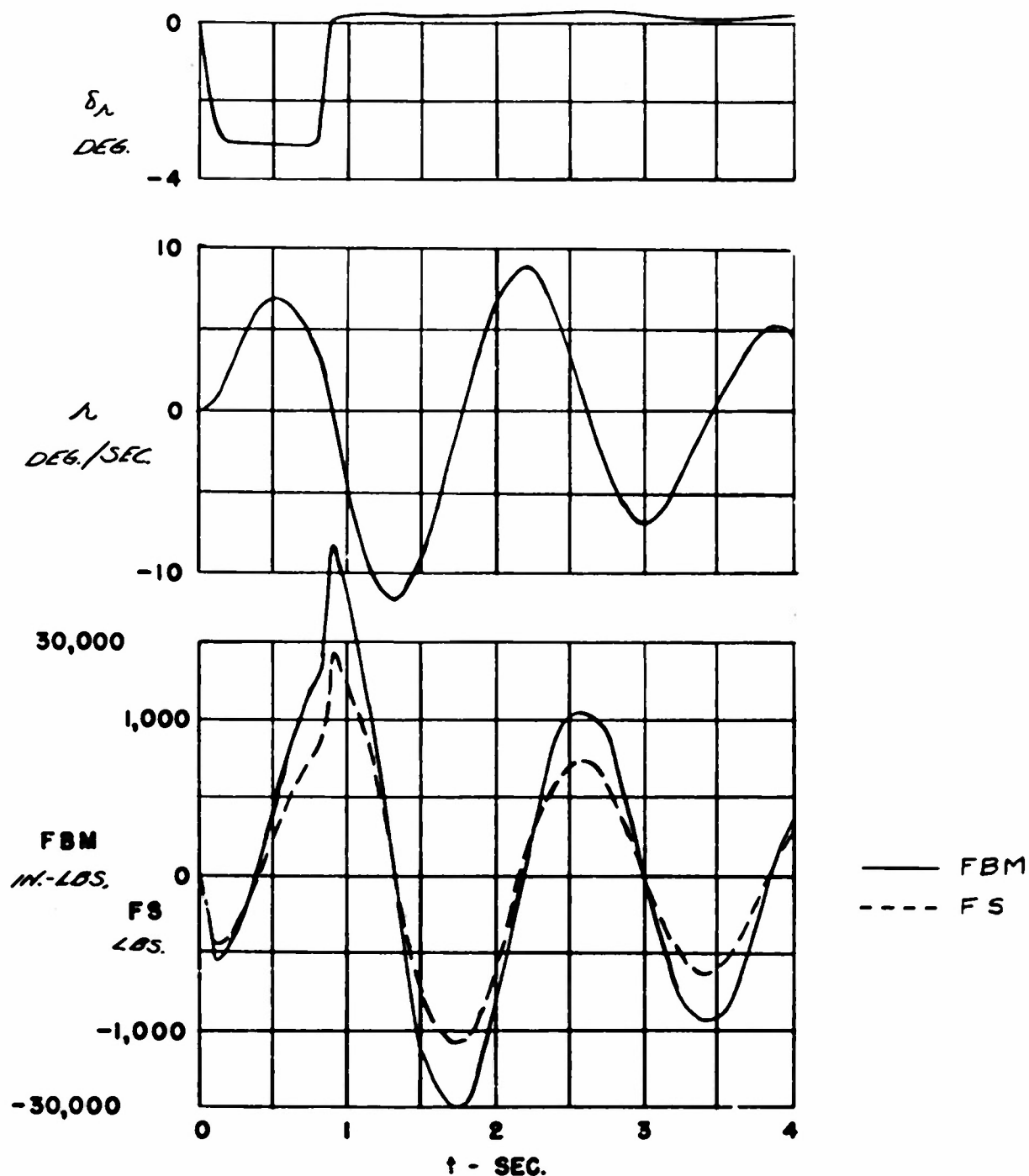


Figure 55

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

RUDDER  $\delta_R$   $3.2^\circ R$

KICK DURATION  $T_1$  .9 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

AILERON LOCKED

FLIGHT 35

RUN 9313

TIP TANKS OFF

ALTITUDE 20,010 FT.

O.A.T.  $-11.6^\circ C$

$V_0$  357.7 MPH

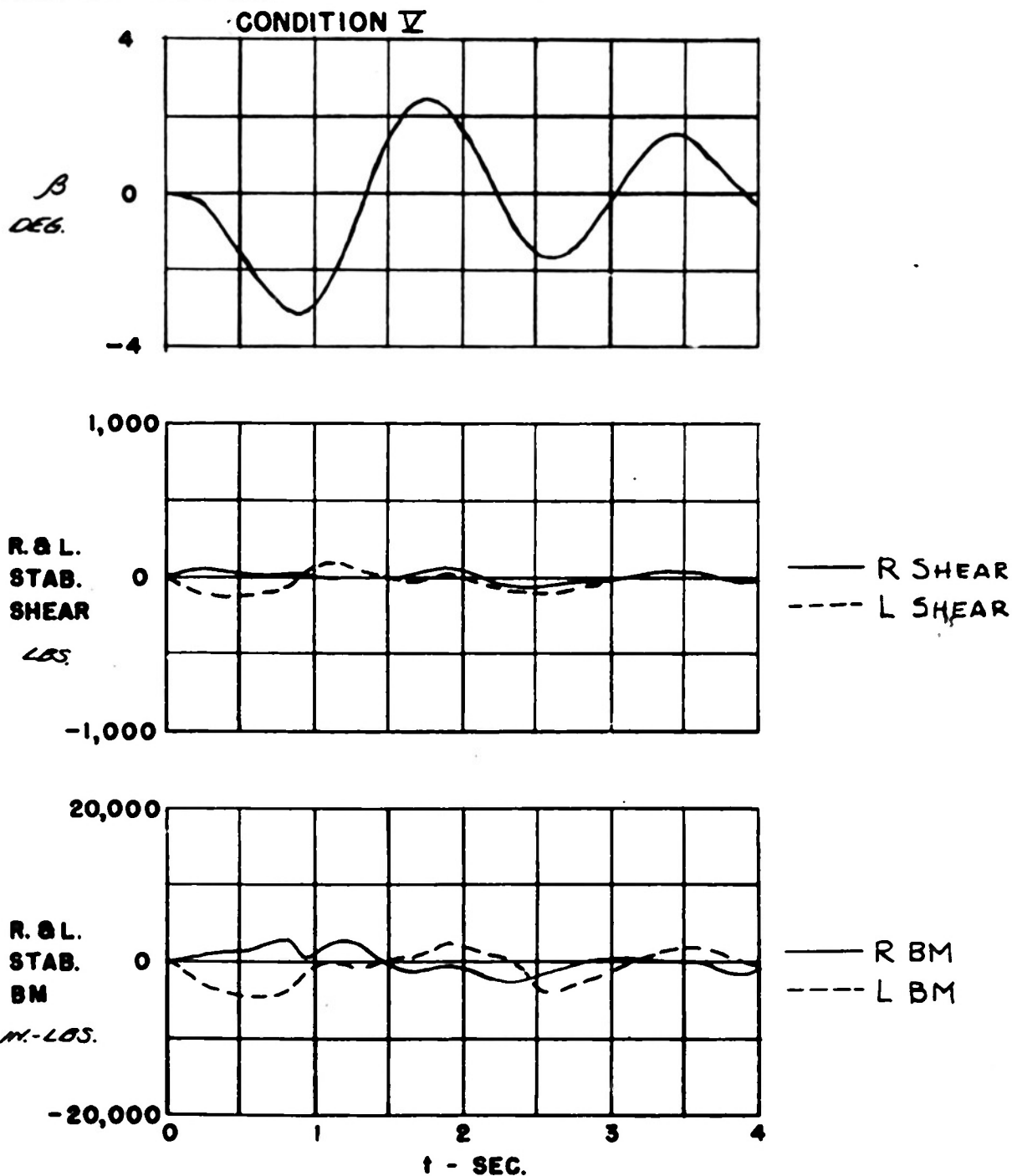


Figure 56

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .69

FLIGHT 35

RUDDER  $\delta_R$  3.2°R

RUN 9313

KICK DURATION  $T_1$  .9 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,010 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O.A.T. -11.6°C

AILERON LOCKED

$V_0$  357.7 MPH.

## CONDITION V

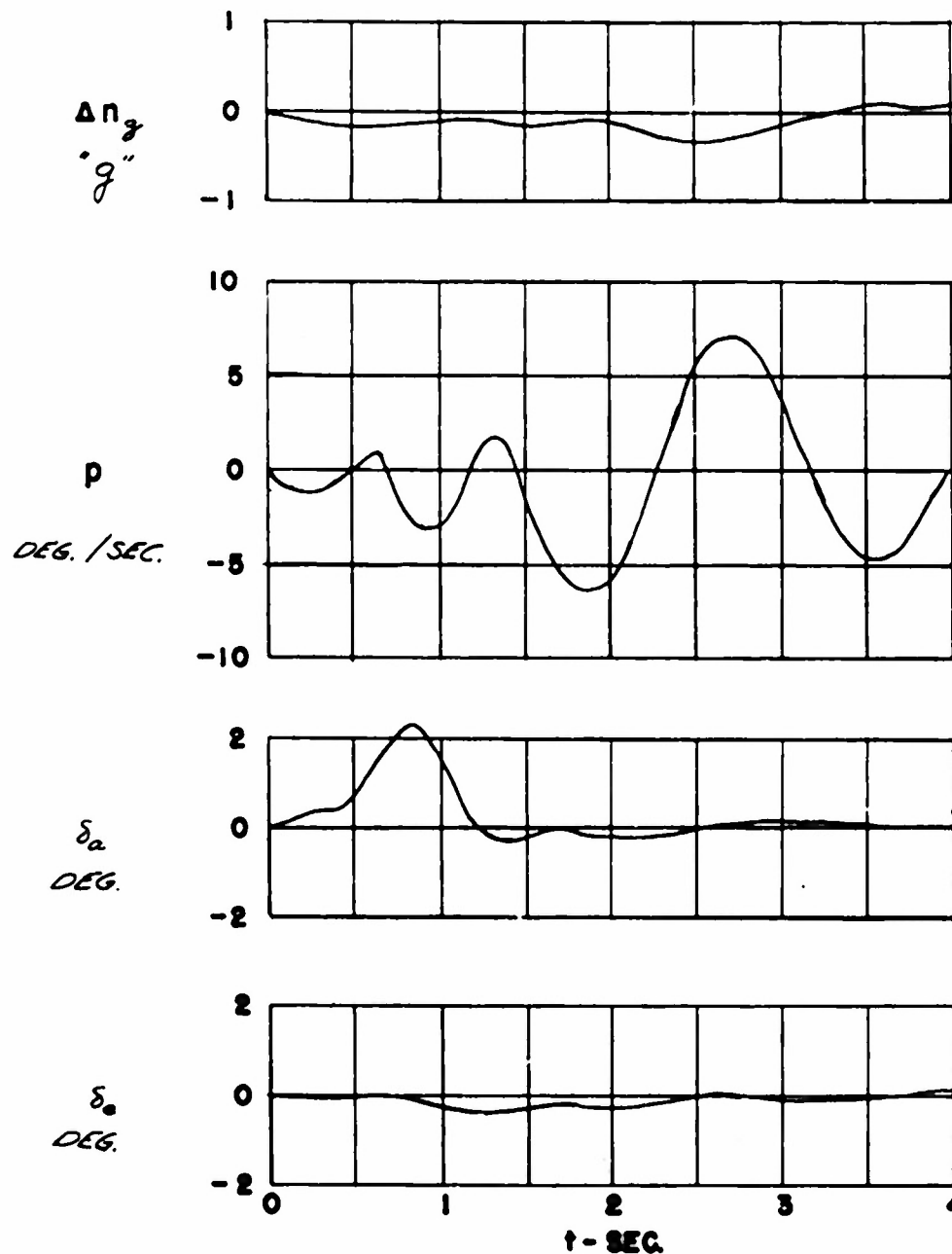


Figure 57

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  4.6°

KICK DURATION  $T_1$  1.1 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9742

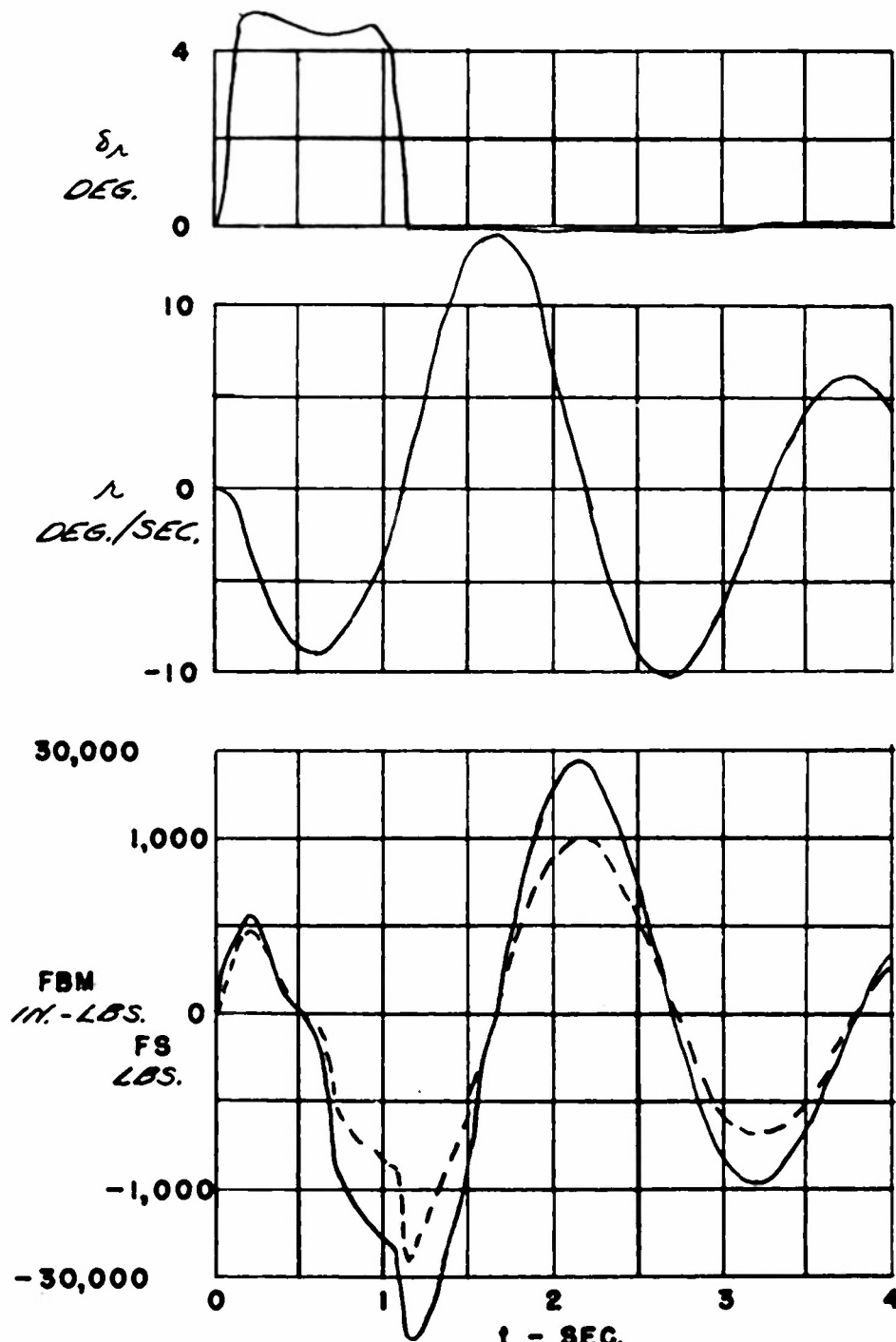
TIP TANKS EMPTY

ALTITUDE 20,100 FT.

O.A.T. -11.5°C

$V_0$  303 MPH

CONDITION VI



1 - SEC.  
Figure 58

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  4.6%

KICK DURATION  $T_1$  1.1 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC

AILERON LOCKED

FLIGHT 38

RUN 9742

TIP TANKS EMPTY

ALTITUDE 20,100 FT.

O.A.T. -11.5°C

$V_0$  303 MPH

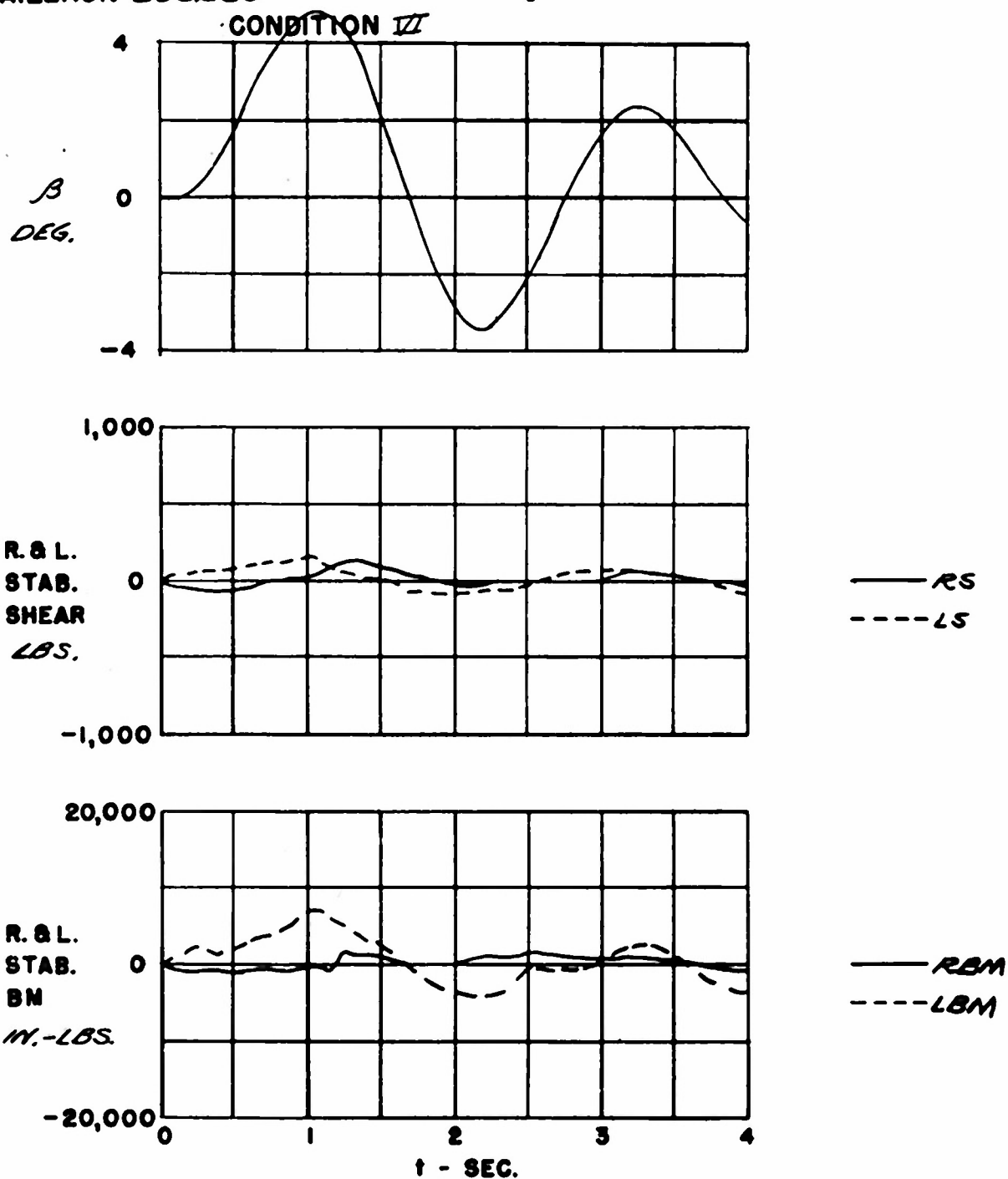


Figure 59

# F 80 A RUDDER KICK FLIGHT TESTS.

MACH NUMBER .59

RUDDER  $\delta_R$  4.6°

KICK DURATION  $T_1$  1.1 SEC

TIME TO APPLY  $\Delta T_1$  .25 SEC.

TIME TO RETURN  $\Delta T_2$  .25 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9742

TIP TANKS EMPTY

ALTITUDE 20,100 FT.

O.A.T. -11.5°C

$V_0$  303 MPH

## CONDITION VII

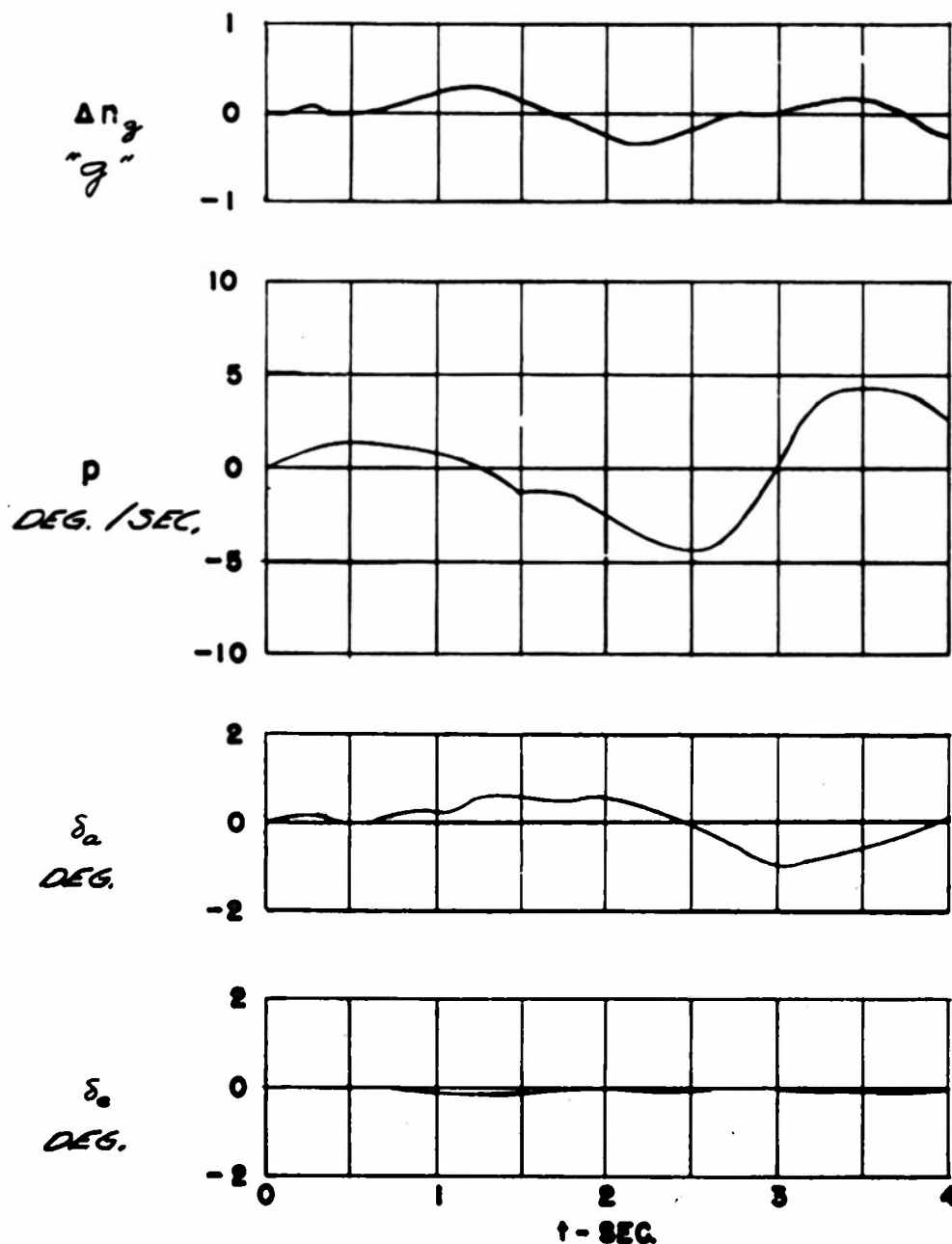


Figure 60

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  3.0°R

KICK DURATION  $T_1$  1.1 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9744

TIP TANK EMPTY

ALTITUDE 20,170 FT.

O.A.T. -11.2 °C

$V_0$  304 MPH

CONDITION VI

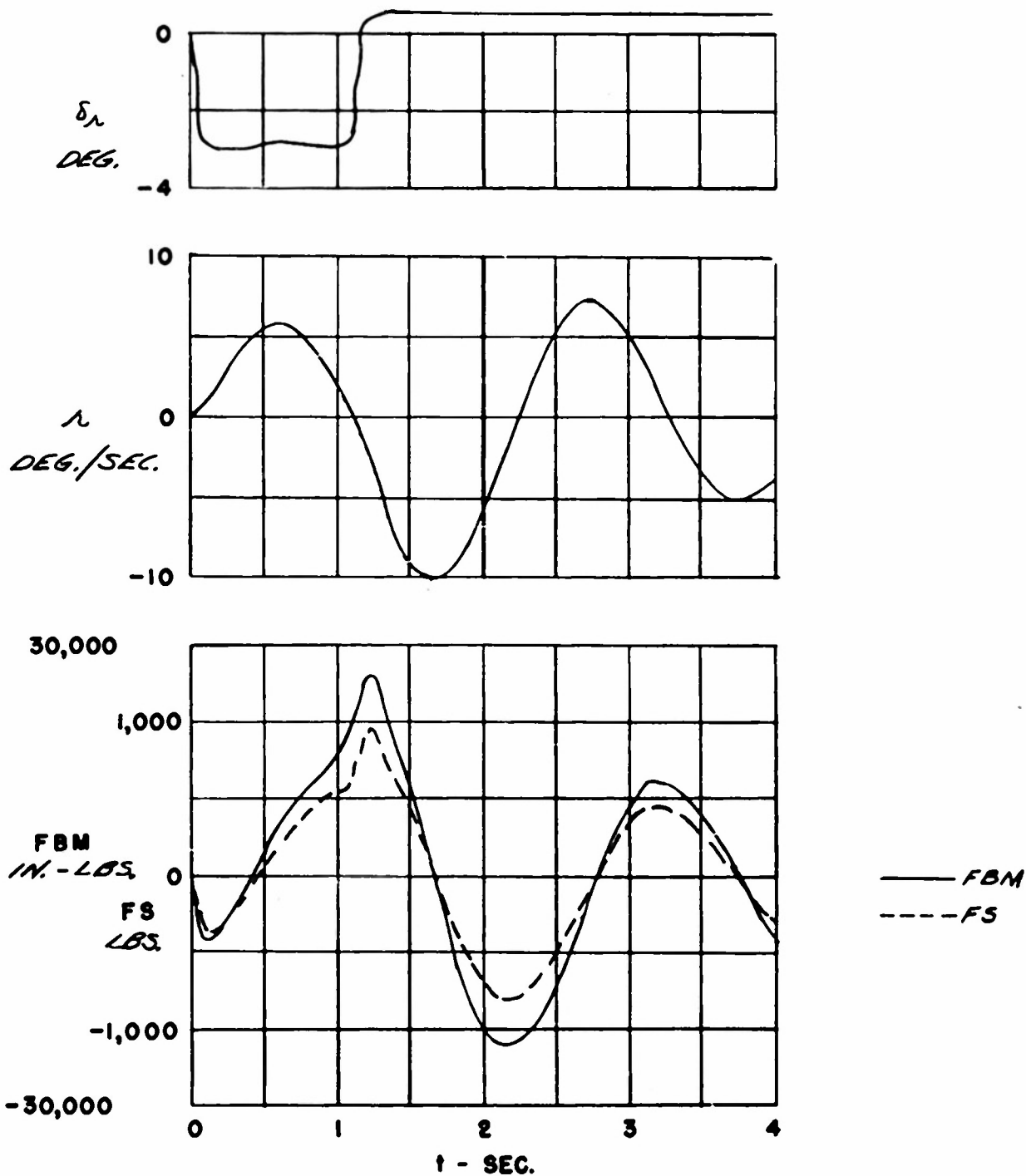


Figure 61

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  30°R

KICK DURATION  $T_1$  1.1 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9744

TIP TANKS EMPTY

ALTITUDE 20,170 FT.

O.A.T. -11.2°C

$V_0$  304 MPH

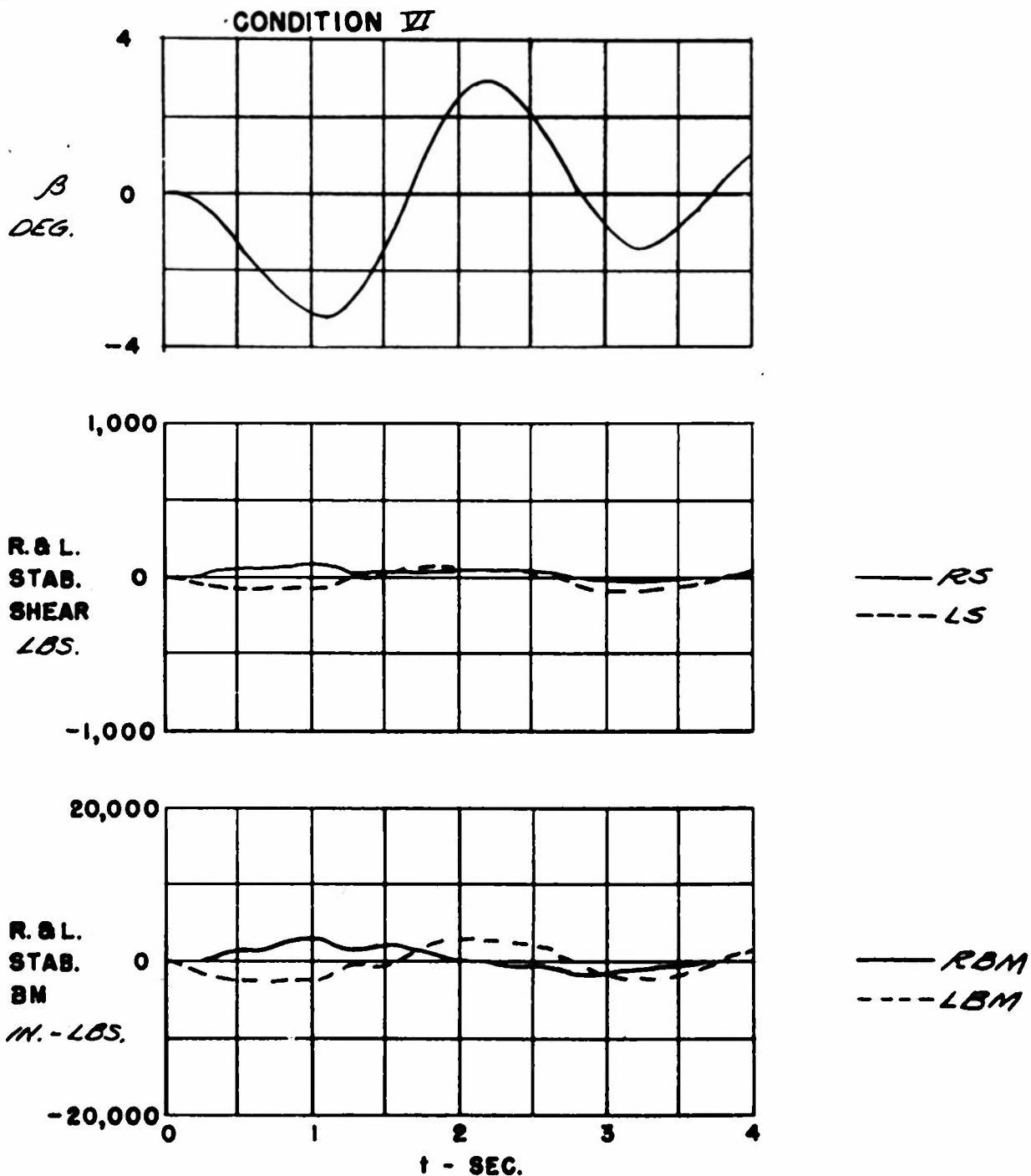


Figure 62

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 38

RUDDER  $\delta_R$  3.0°R

RUN 9744

KICK DURATION  $T_1$  1.1 SEC

TIP TANKS EMPTY

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,170 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -11.2°C

AILERON LOCKED

$V_0$  304 MPH

CONDITION VI

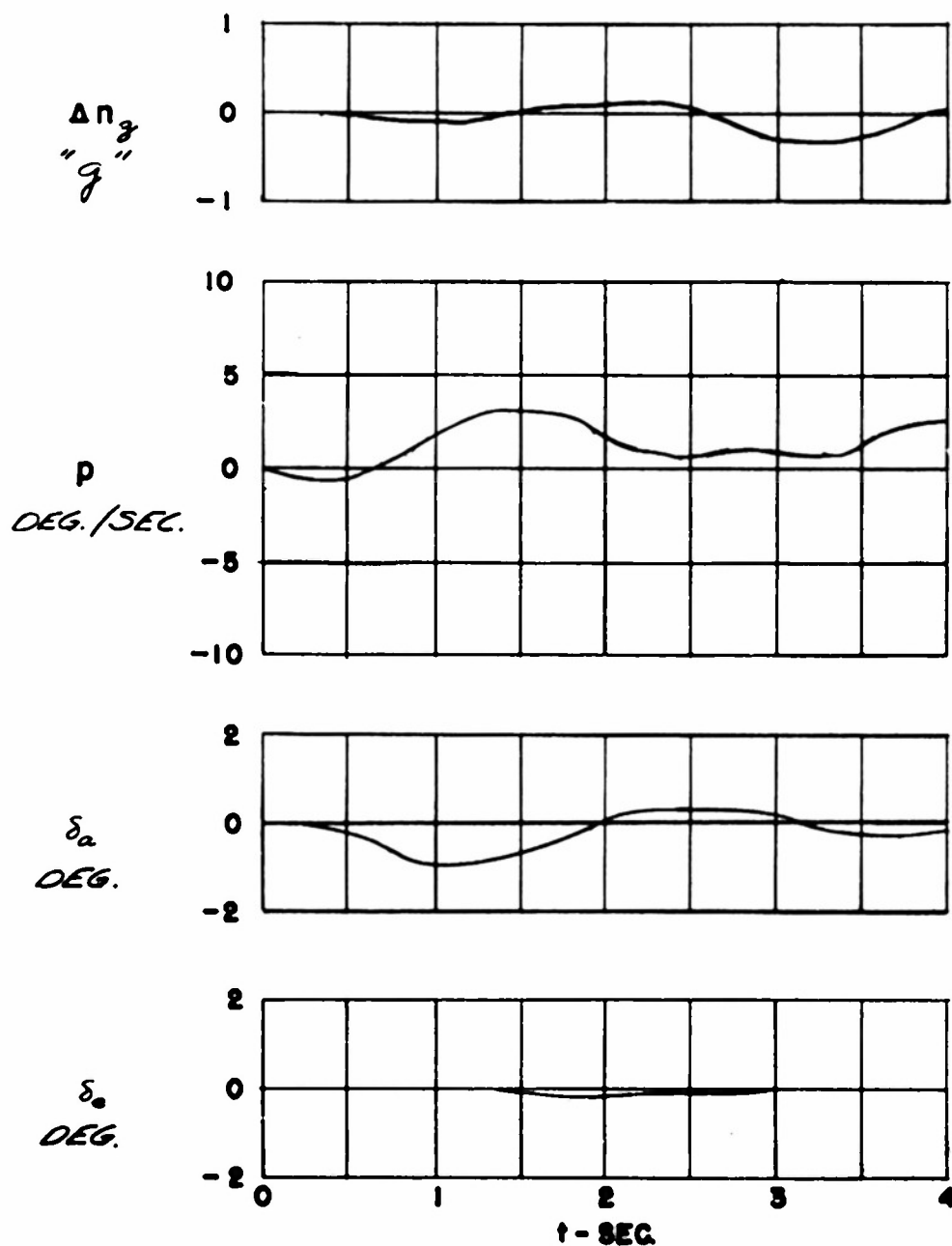


Figure 63

AFTR-6743

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 38

RUDDER  $\delta_R$  3.4°

RUN 9747

KICK DURATION  $T_1$  .8 SEC

TIP TANKS EMPTY

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 20,038 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O.A.T. -11.6°C

AILERON LOCKED

$V_0$  304.6 MPH

CONDITION VI

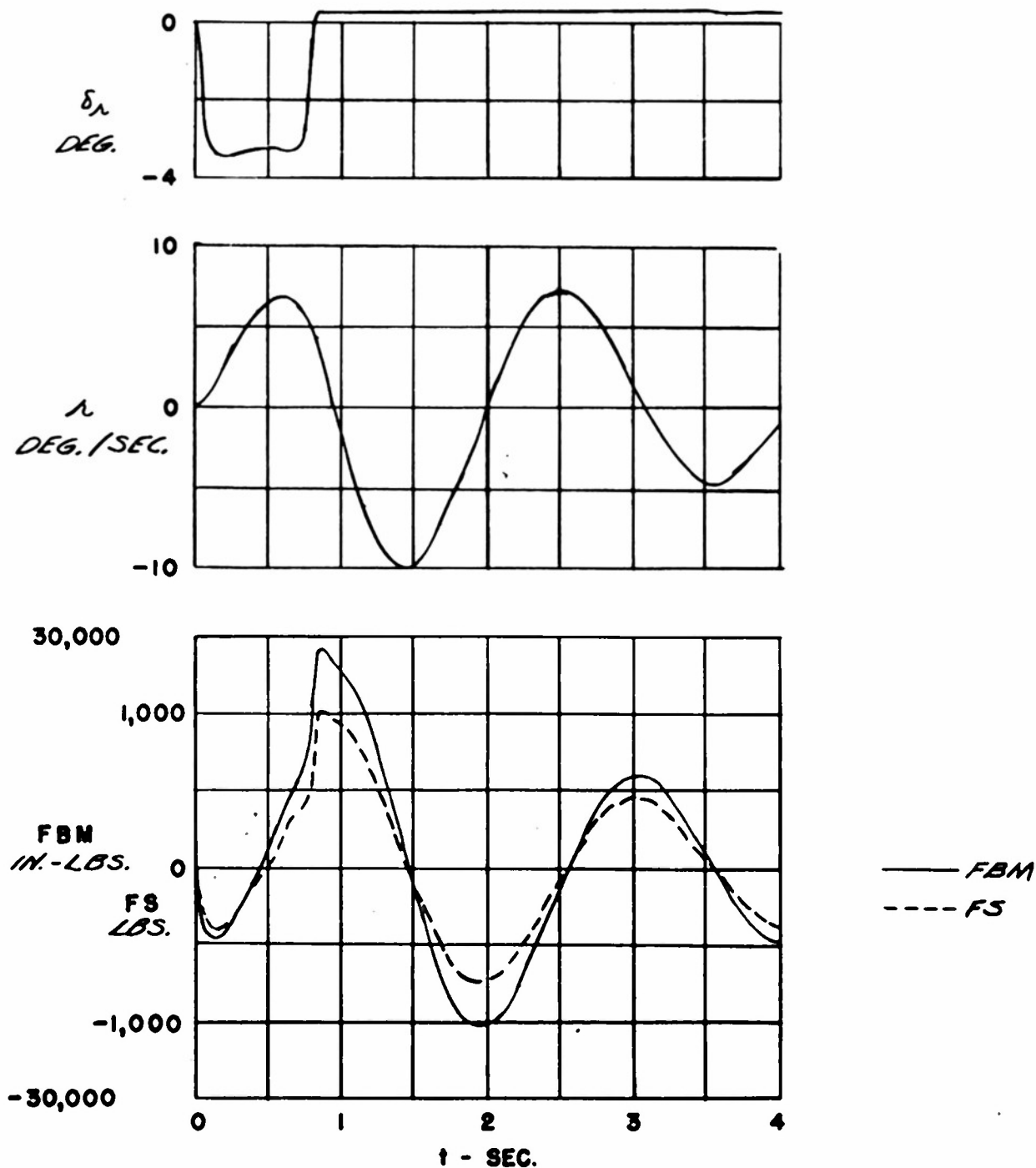


Figure 64

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  3.4°R

KICK DURATION  $T_1$  .8 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .1 SEC

AILERON LOCKED

FLIGHT 38

RUN 9749

TIP TANKS EMPTY

ALTITUDE 29,038 FT.

O.A.T. -11.6°C

$V_0$  304.6 MPH

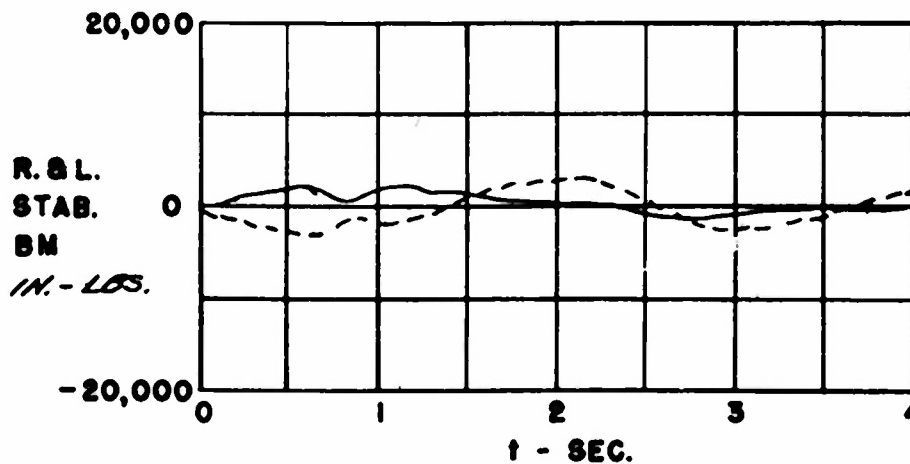
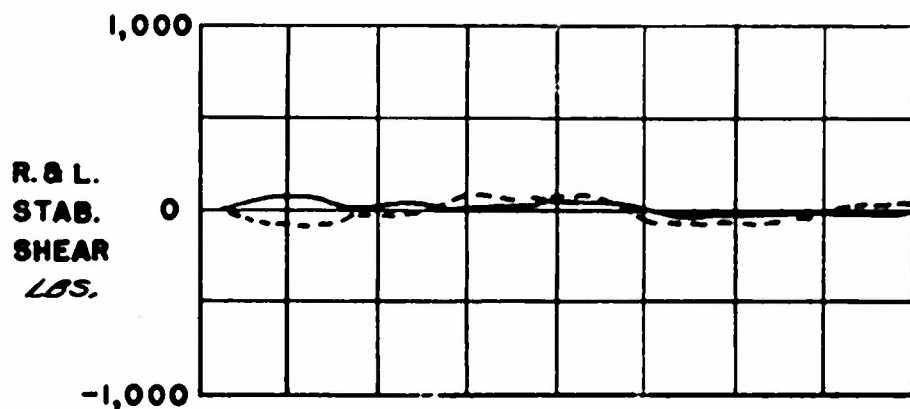
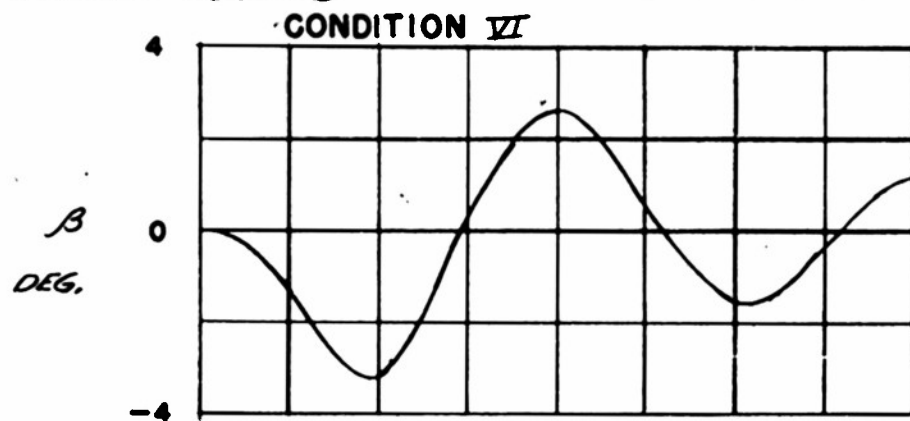


Figure 65

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  3.4°R

KICK DURATION  $T_1$  .8 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .1 SEC

AILERON LOCKED

FLIGHT 38

RUN 9747

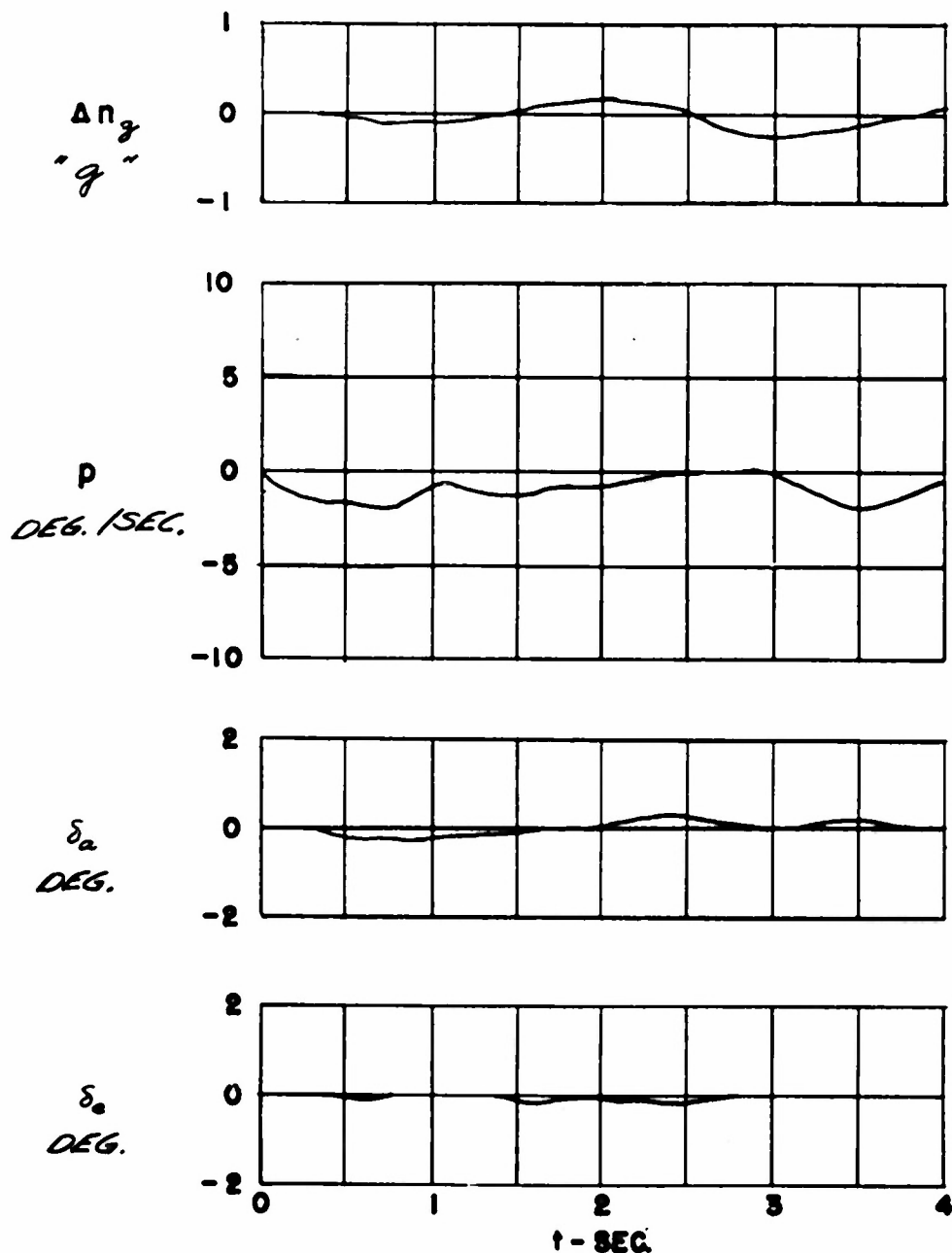
TIP TANKS EMPTY

ALTITUDE 20,038 FT.

O.A.T. -11.6 °C

$V_0$  304.6 MPH

CONDITION VI



t - SEC.  
Figure 66

# F 80A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 38

RUDDER  $\delta_R$  3.4°R

RUN 9748

KICK DURATION  $T_1$  1.5 SEC.

TIP TANKS EMPTY

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 19,967 FT.

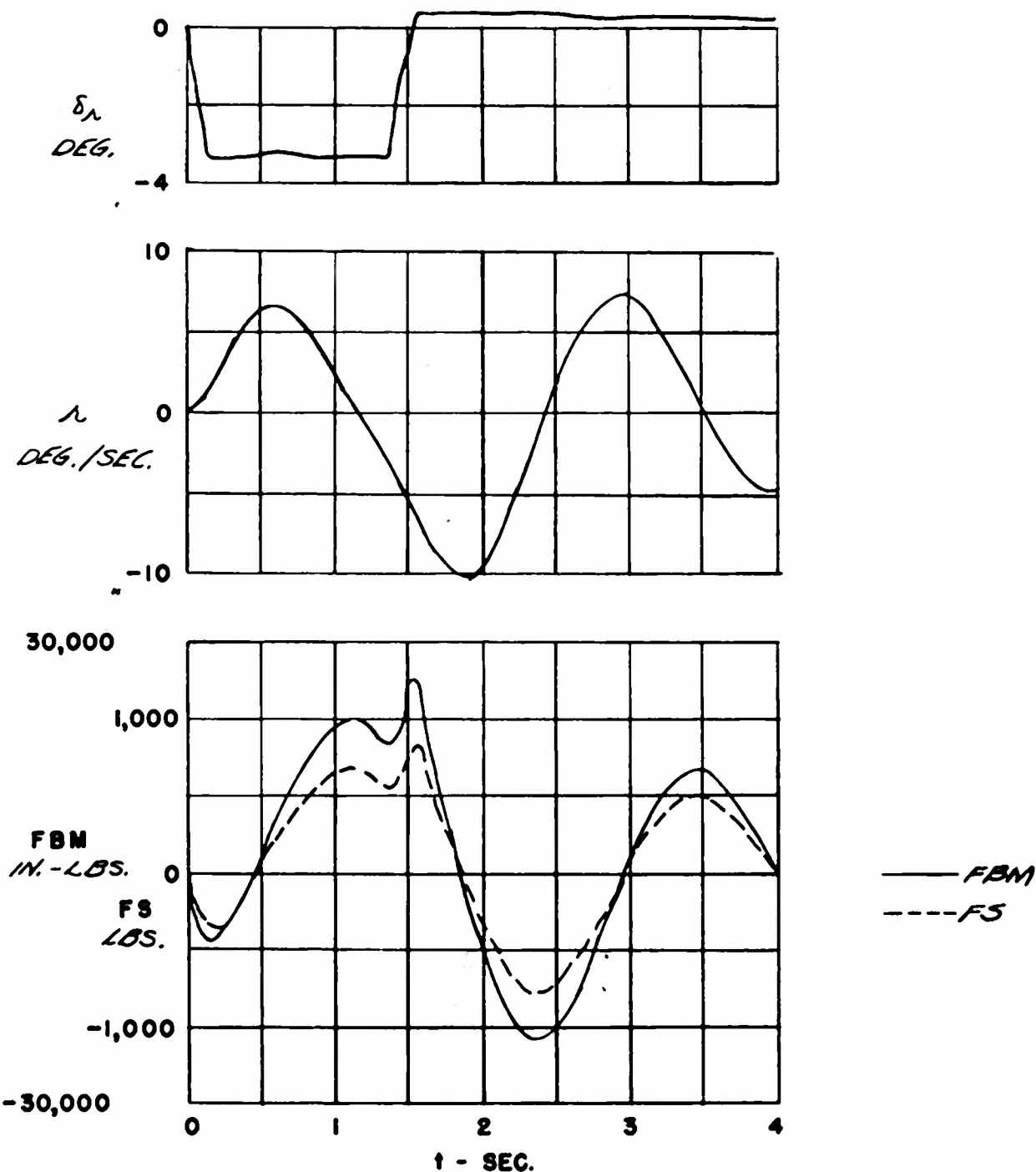
TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -11.2°C

AILERON LOCKED

$V_0$  303.7 MPH

CONDITION VI



t - SEC.

Figure 67

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  9.4°R

KICK DURATION  $T_1$  1.5 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9748

TIP TANKS EMPTY

ALTITUDE 19,967 FT.

O.A.T. -112 °C

$V_0$  303.7 MPH.

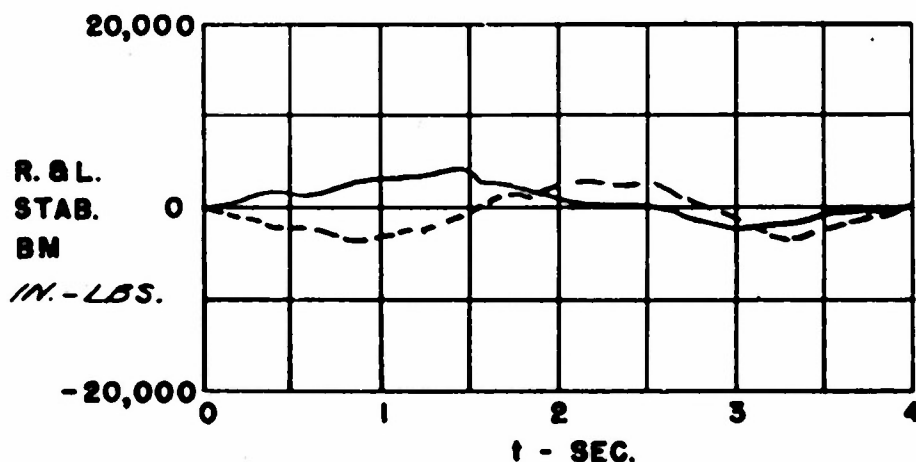
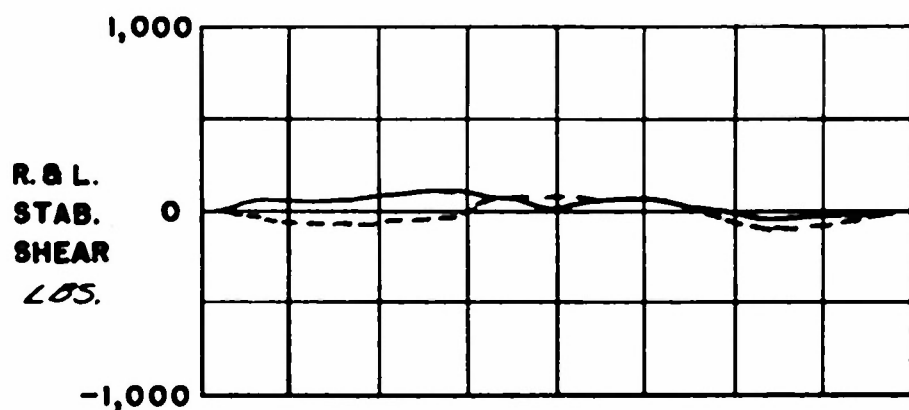
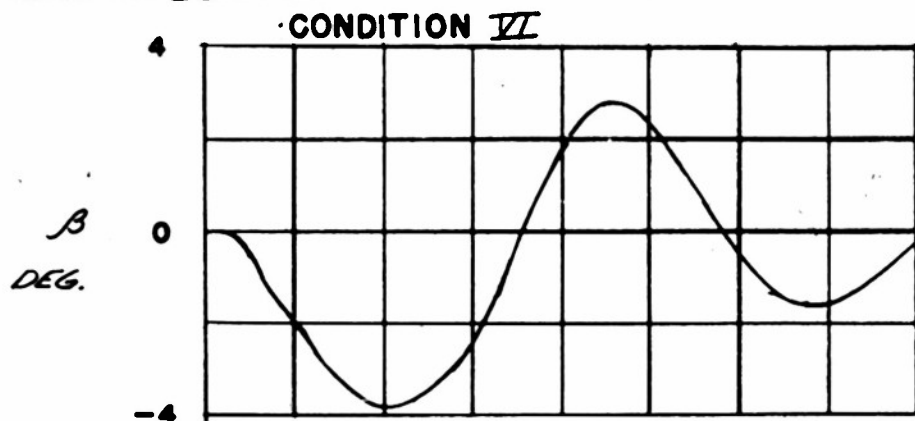


Figure 68

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  3.4°R

KICK DURATION  $T_1$  1.5 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9748

TIP TANKS EMPTY

ALTITUDE 19,967 FT.

O.A.T. -11.2°C

$V_0$  303.7 MPH

## CONDITION VI

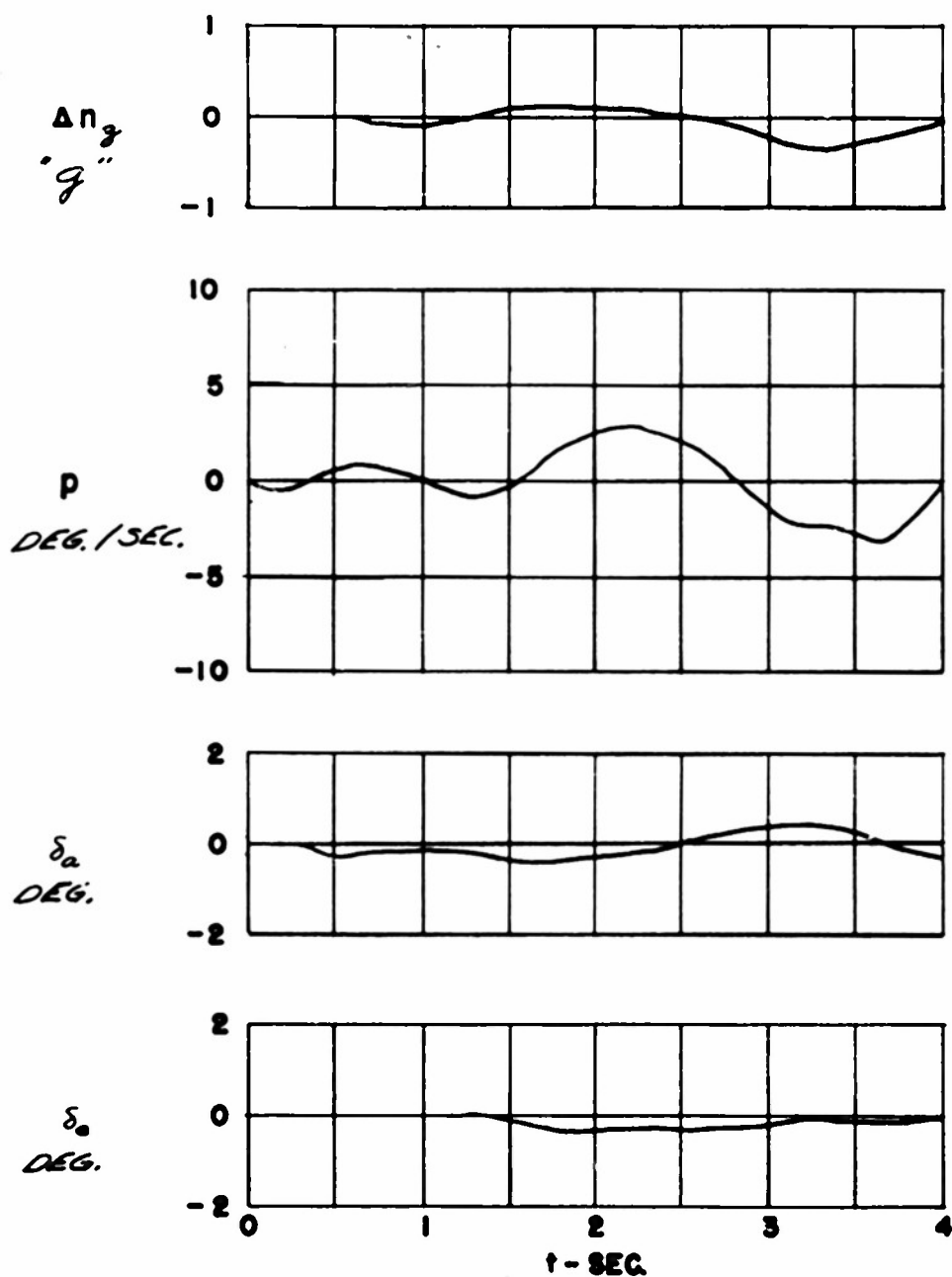


Figure 69

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  4.4°

KICK DURATION  $T_1$  1.1 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .1 SEC

AILERON LOCKED

FLIGHT 38

RUN 9739

TIP TANKS HALF FULL

ALTITUDE 20,130 FT.

O.A.T. -11.2 °C

$V_0$  303 MPH

CONDITION VII

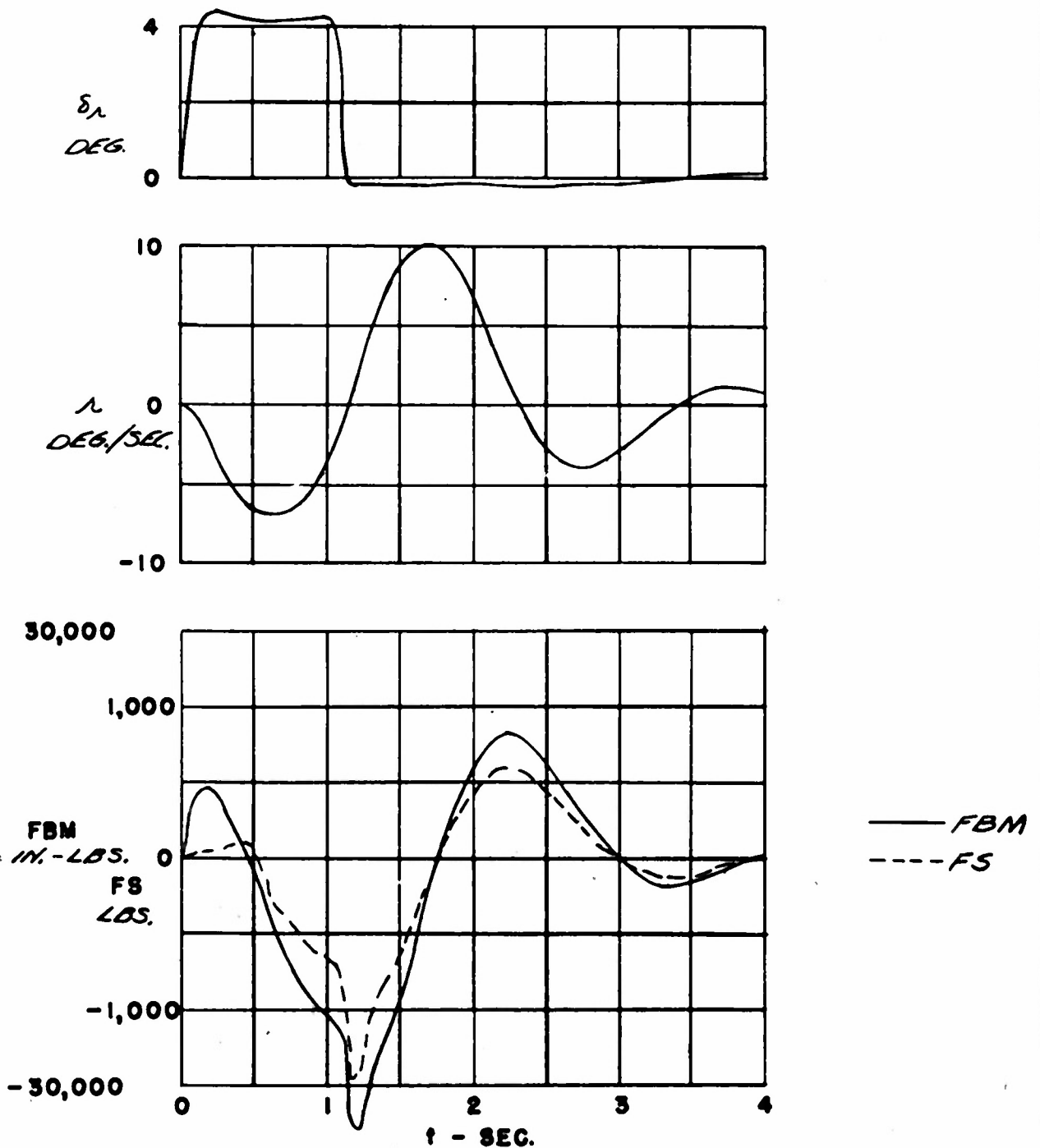


Figure 70

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

RUDDER  $\delta_R$  4.4%

KICK DURATION  $T_1$  1.1 SEC

TIME TO APPLY  $\Delta T_1$  .2 SEC

TIME TO RETURN  $\Delta T_2$  .1 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9739

TIP TANKS HALF FULL

ALTITUDE 20,130 FT

O.A.T. -11.2 °C

$V_0$  303 MPH

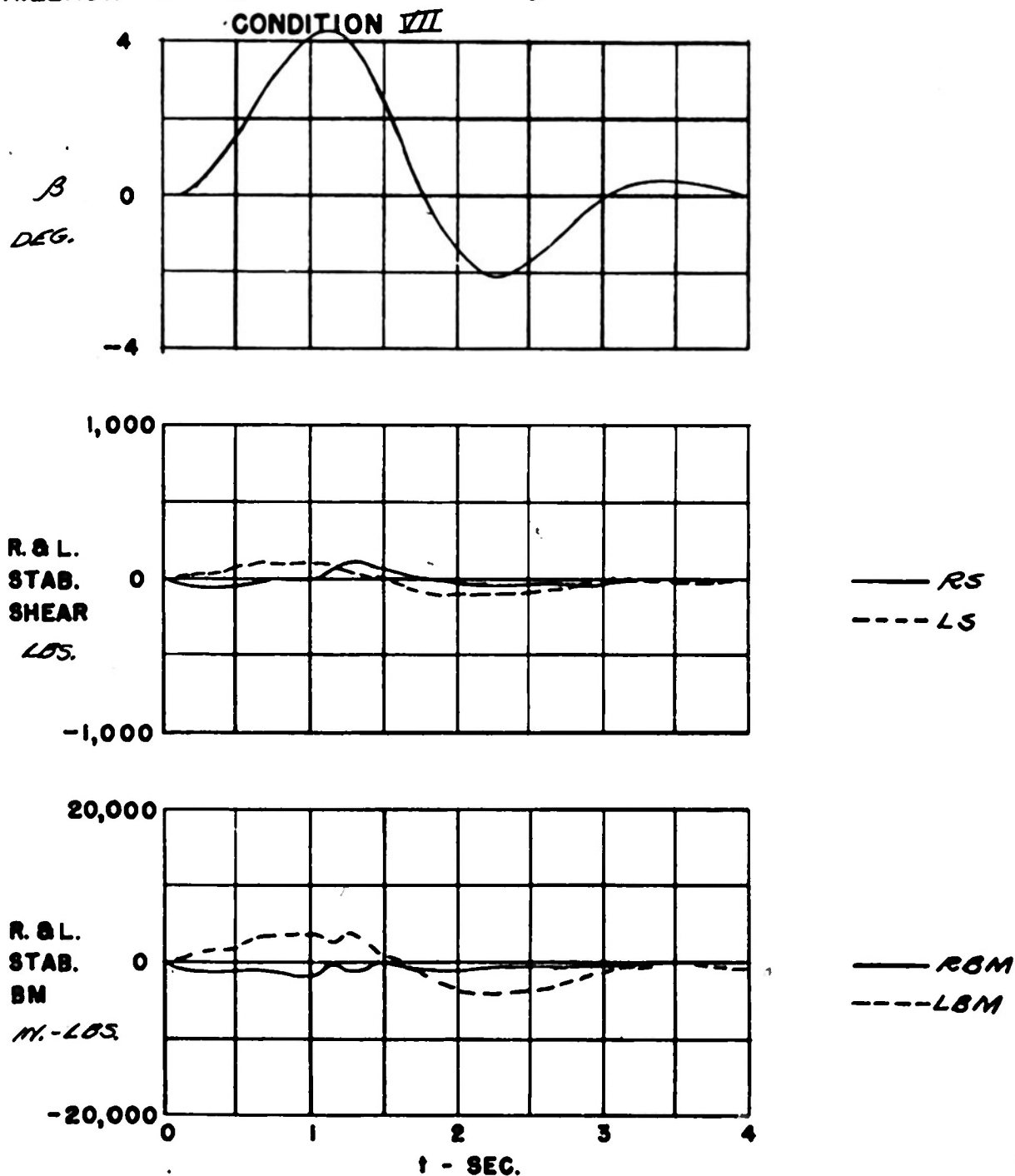


Figure 71

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 38

RUDDER  $\delta_R$  4.4%

RUN 9739

KICK DURATION  $T_1$  1.1 SEC

TIP TANKS HALF FULL

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 20,130 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC

O. A. T. -11.2°C

AILERON LOCKED

$V_0$  303 MPH

CONDITION VII

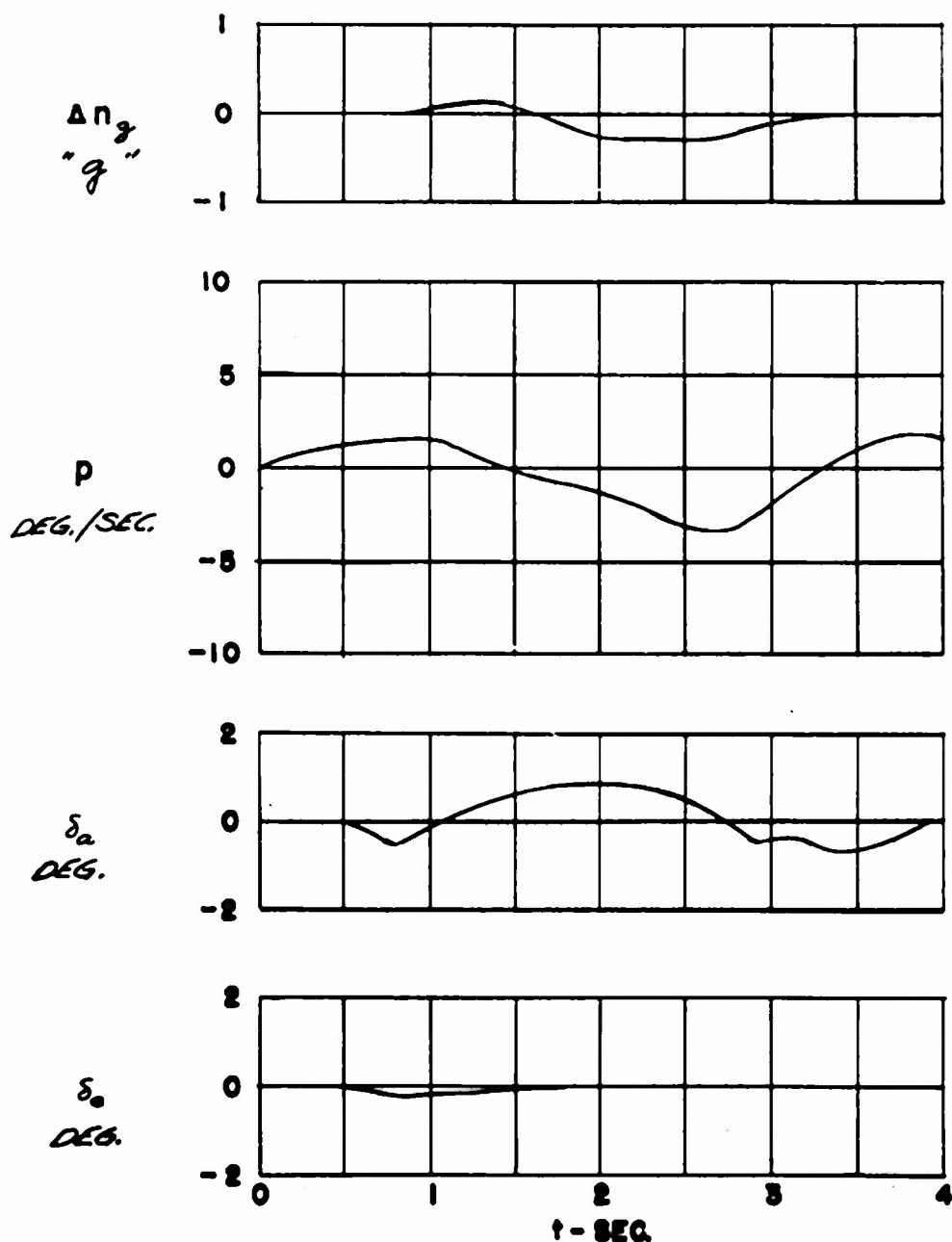


Figure 72

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58

RUDDER  $\delta_R$  3.5°R

KICK DURATION  $T_1$  1.3 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

AILERON LOCKED

FLIGHT 38

RUN 9735

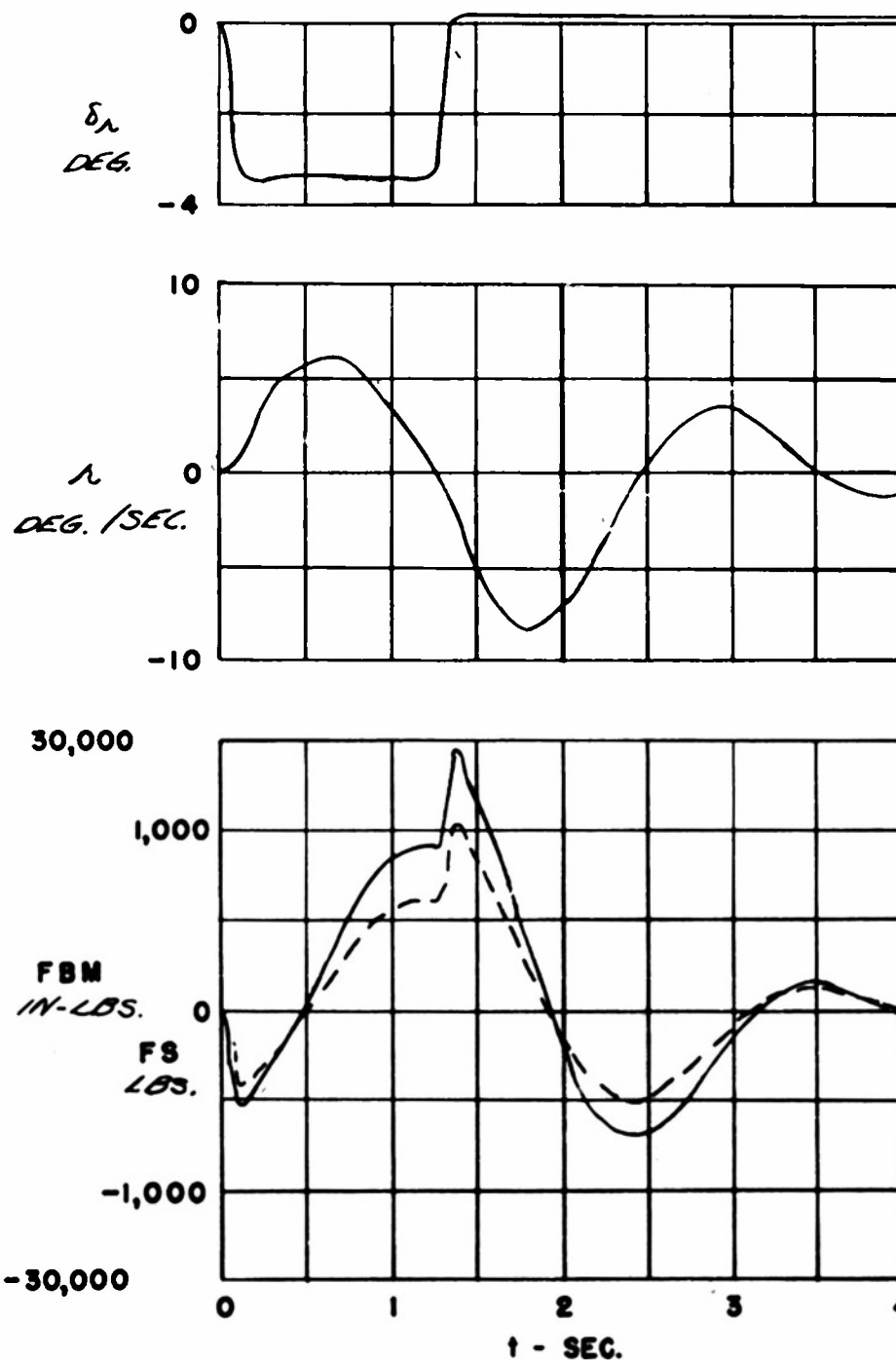
TIP TANKS HALF FULL

ALTITUDE 19,990 FT

O.A.T. -11.4°C

$V_0$  301.6 MPH

## CONDITION VII



t - SEC.

Figure 73

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# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58

RUDDER  $\delta_R$  3.5°R

KICK DURATION  $T_1$  1.3 SEC.

TIME TO APPLY  $\Delta T_1$  .2 SEC.

TIME TO RETURN  $\Delta T_2$  .1 SEC

AILERON LOCKED

FLIGHT 38

RUN 9735

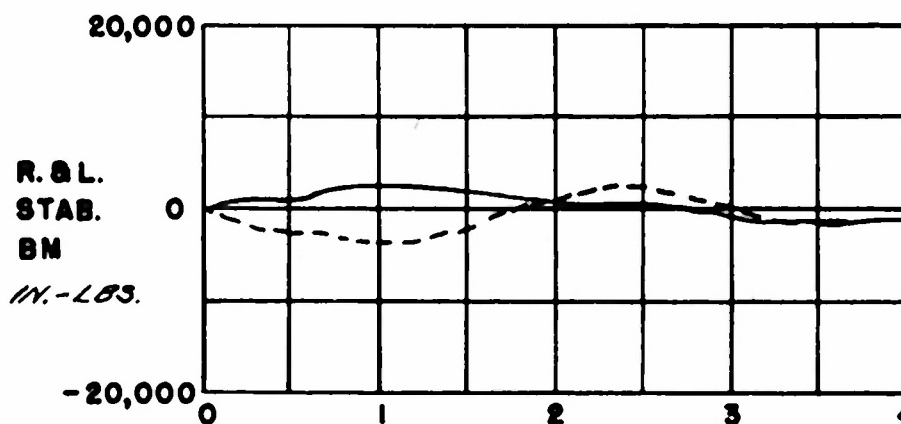
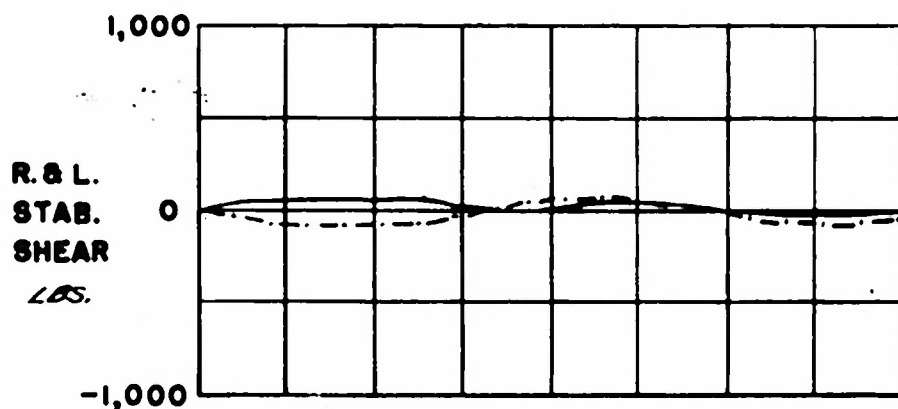
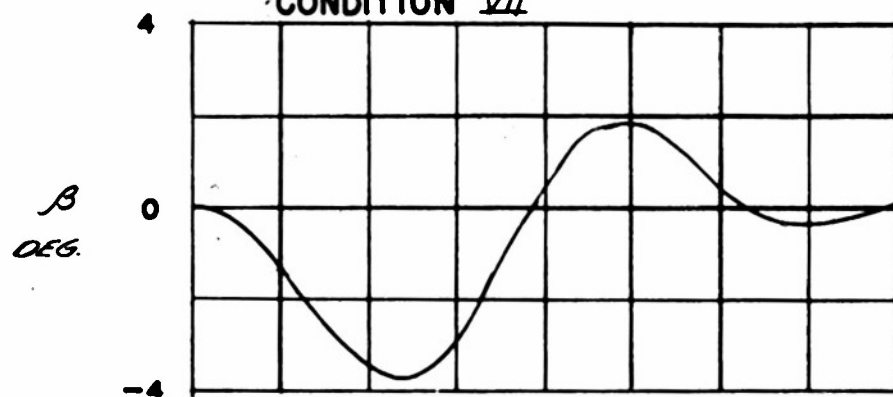
TIP TANKS HALF FULL

ALTITUDE 19,990 FT.

O. A. T. -11.4°C

$V_0$  301.6 MPH

CONDITION VII



t - SEC.

Figure 74

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .58

FLIGHT 38

RUDDER  $\delta_R$  35°R

RUN 9735

KICK DURATION  $T_1$  1.3 SEC.

TIP TANKS HALF FULL

TIME TO APPLY  $\Delta T_1$  .2 SEC

ALTITUDE 19990 FT.

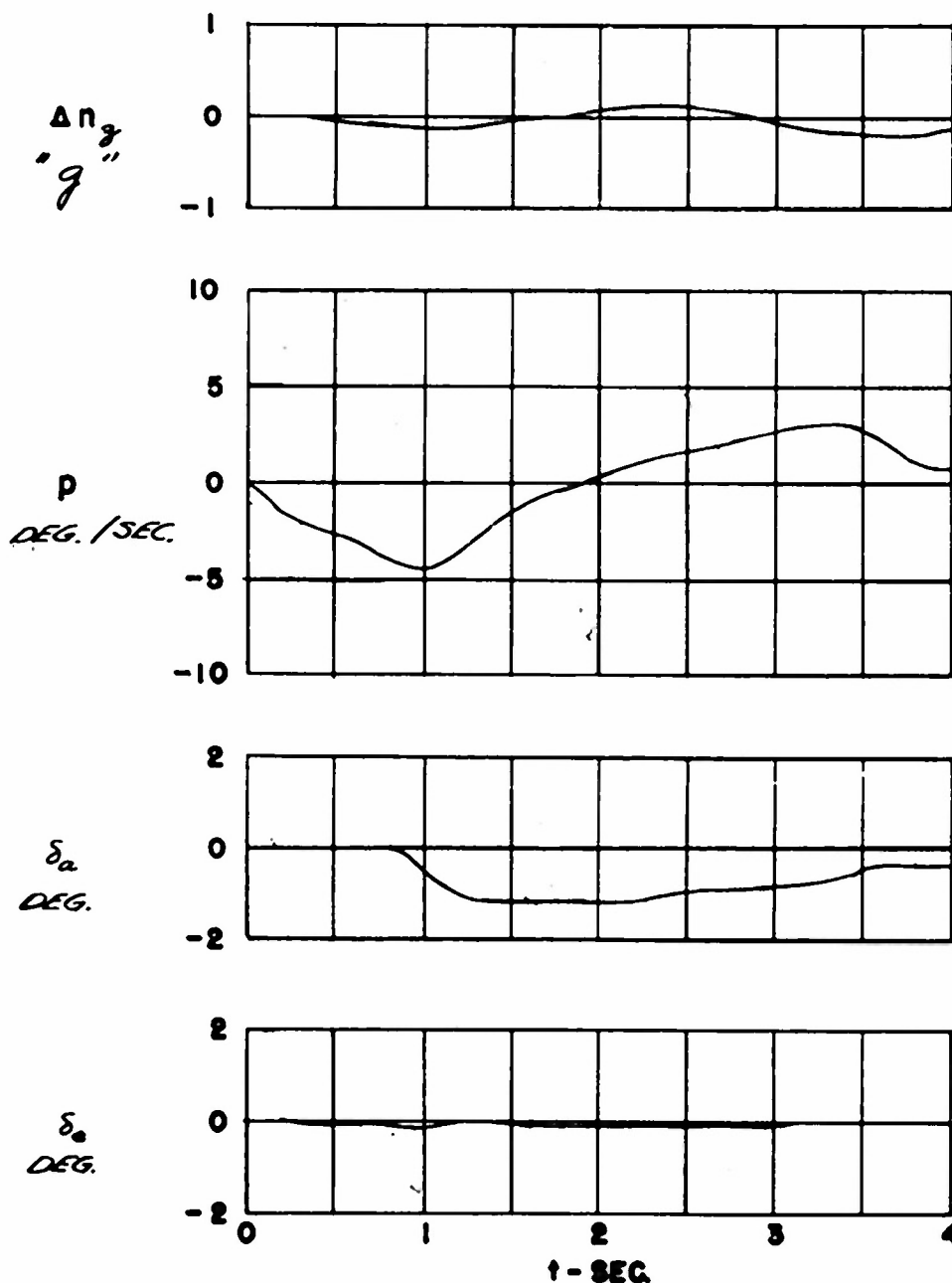
TIME TO RETURN  $\Delta T_2$  .1 SEC

O.A.T. -11.4°C

AILERON LOCKED

$V_0$  301.6 MPH

CONDITION VII



↑ - SEC.

Figure 75

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 35

RUDDER  $\delta_R$  3.8°

RUN 9314

KICK DURATION  $T_1$  1.0 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 19,970 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O.A.T. -12.2 °C

AILERON MOVED ANTI ROLL

$V_0$  304.1 MPH

CONDITION VIII

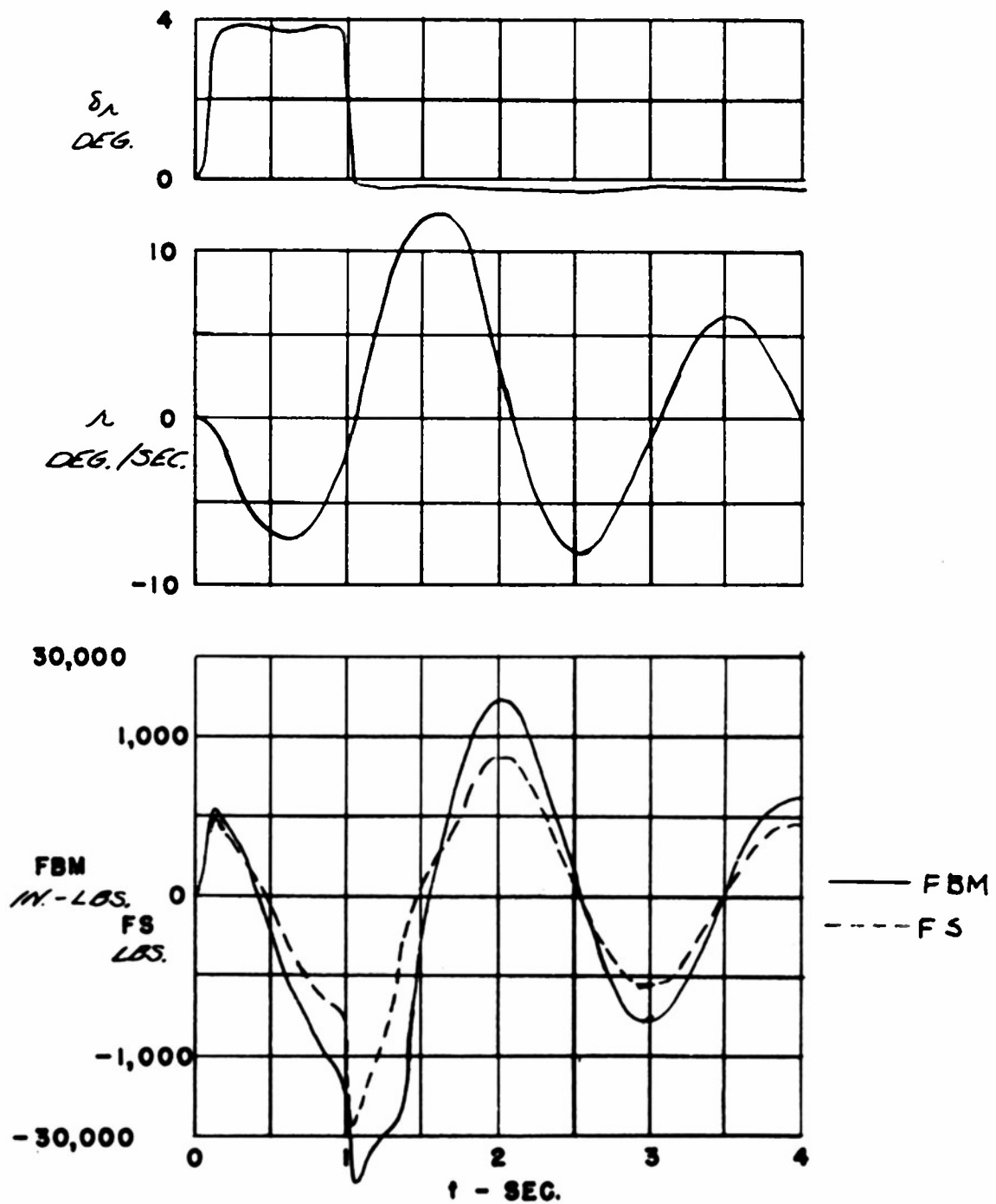


Figure 76

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 35

RUDDER  $\delta_R$  3.8°

RUN 9317

KICK DURATION  $T_1$  1.0 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

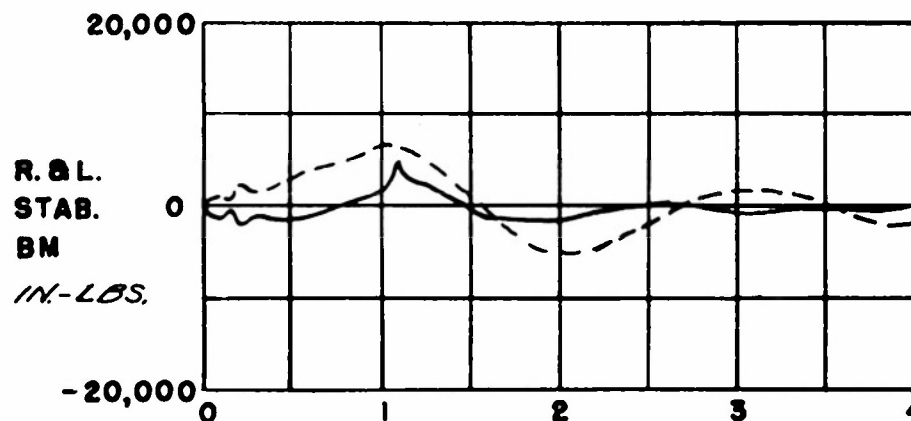
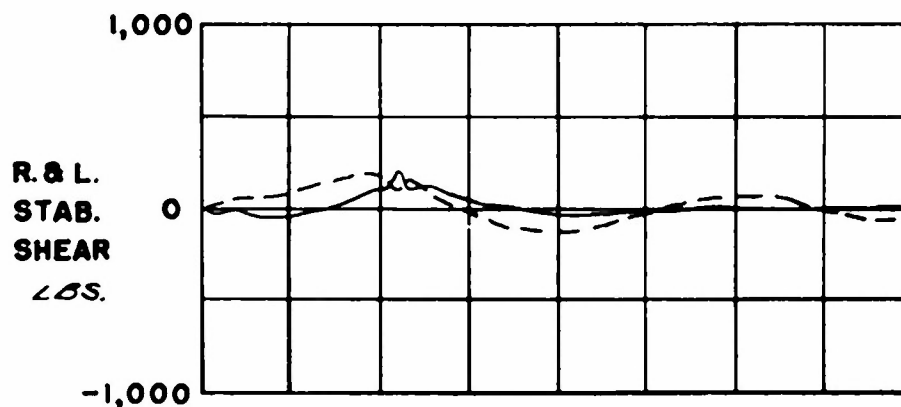
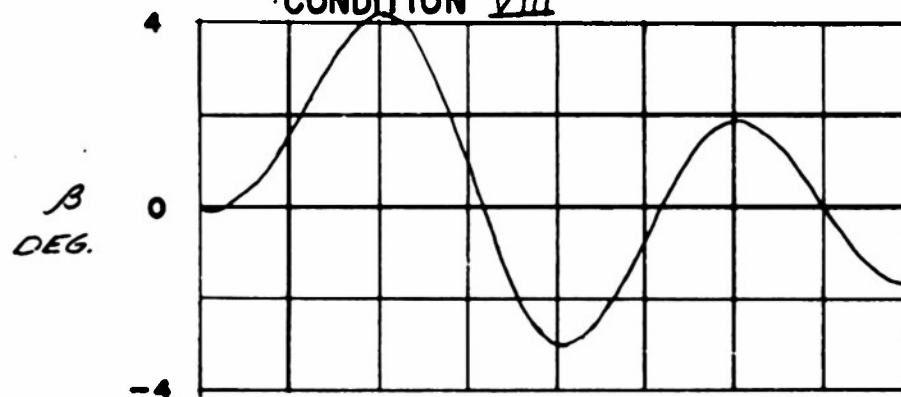
ALTITUDE 19,970 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O.A.T. -12.2 °C

AILERON MOVED ANTI ROLL  $V_0$  304.1 MPH

CONDITION VIII



t - SEC.

Figure 77

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# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 35

RUDDER  $\delta_R$  3.8°

RUN 9317

KICK DURATION  $T_1$  1.0 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 19,970 FT.

TIME TO RETURN  $\Delta T_2$  .1 SEC.

O.A.T. -12.2°C

AILERON MOVED ANTI ROLL

$V_0$  304.1 MPH

CONDITION VIII

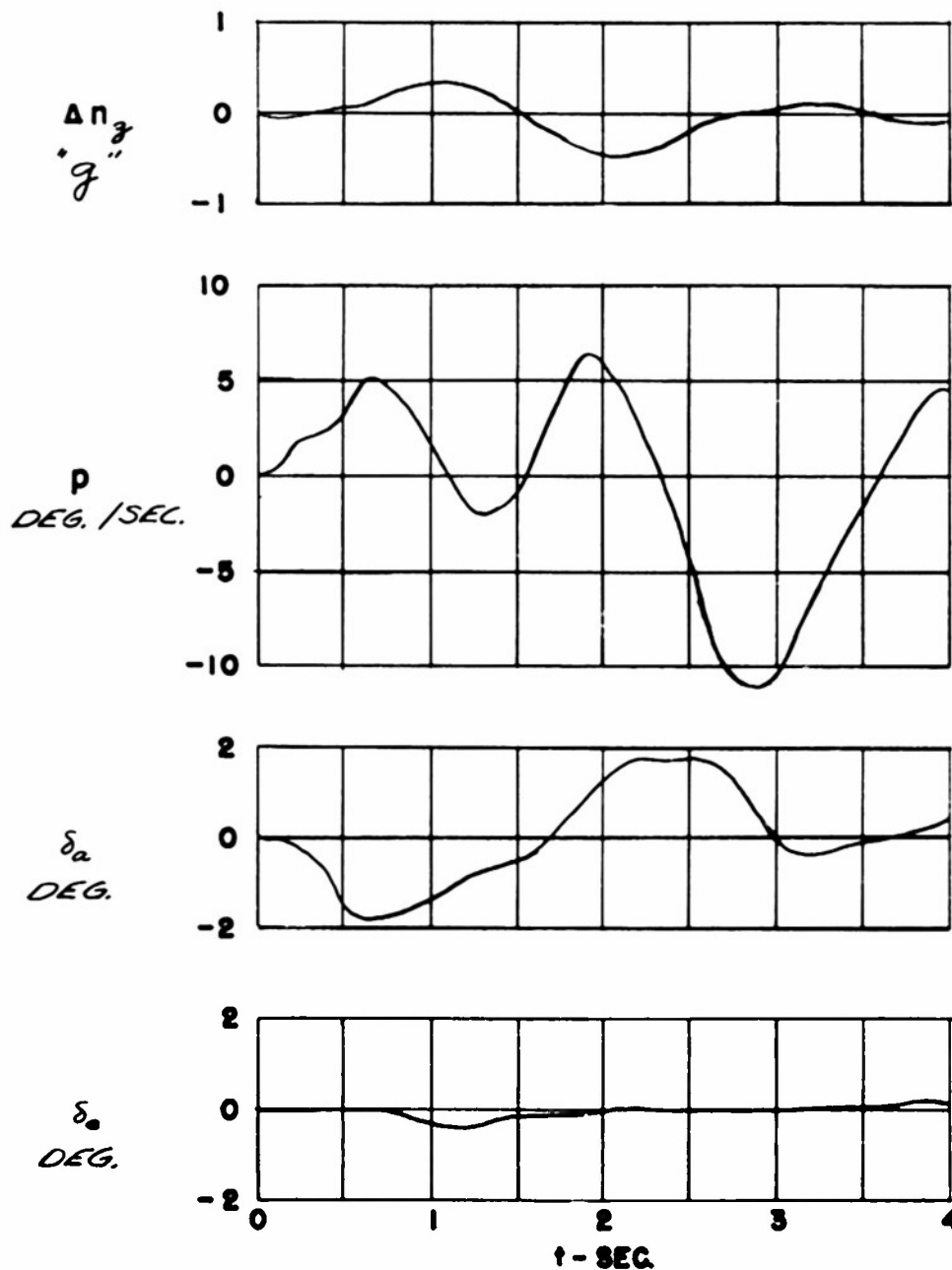


Figure 78

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 37

RUDDER  $\delta_R$  5°

RUN 9689

KICK DURATION  $T_1$  1.2 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,195 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -11.1 °C

AILERON MOVED ANTI ROLL

$V_0$  303 MPH

CONDITION VIII

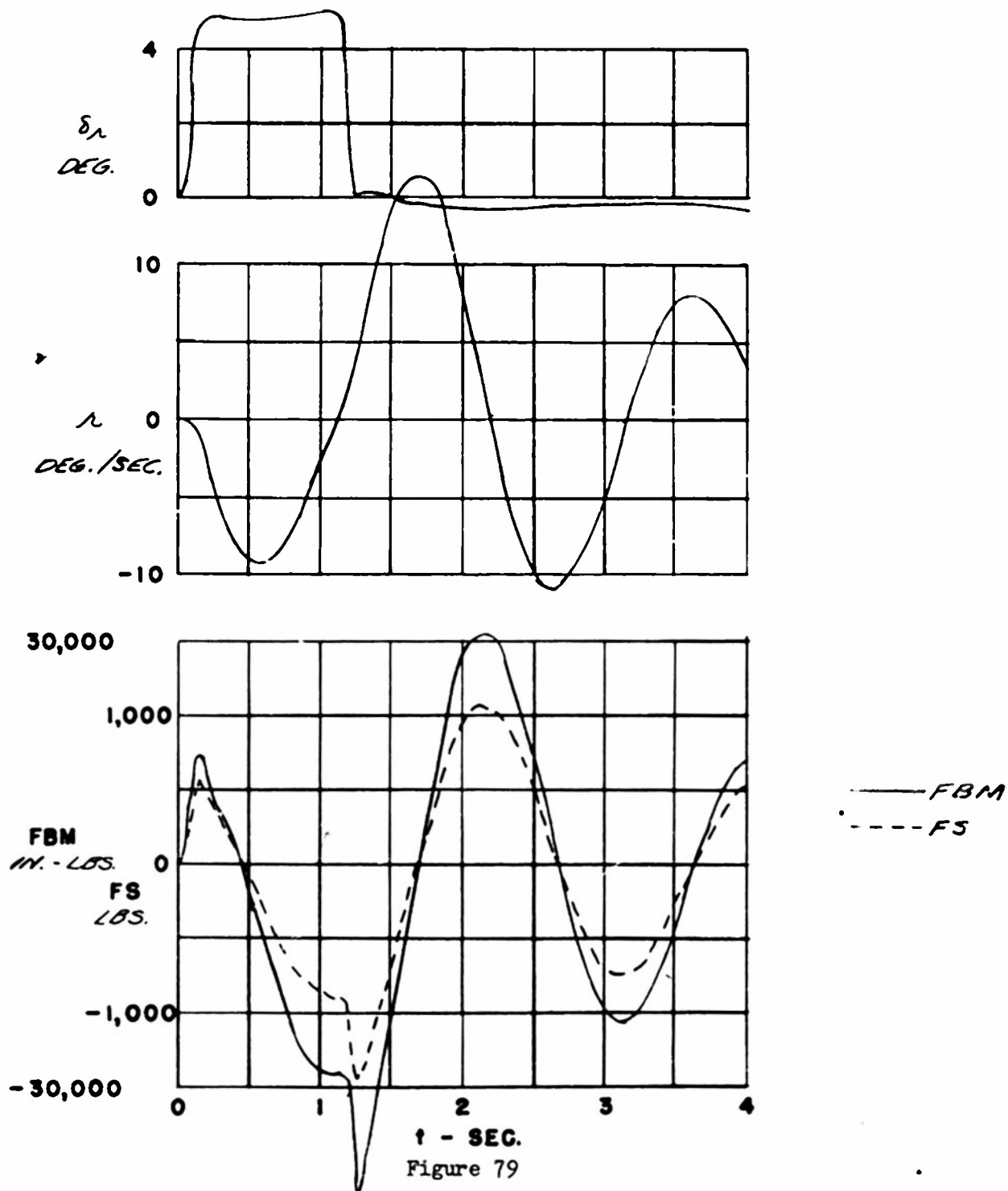


Figure 79

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 37

RUDDER  $\delta_R$   $5^\circ L$

RUN 9689

KICK DURATION  $T_1$  1.2 SEC

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,195 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T.  $-11.1^\circ C$

AILERON MOVED ANTI ROLL  $V_0$  303 MPH

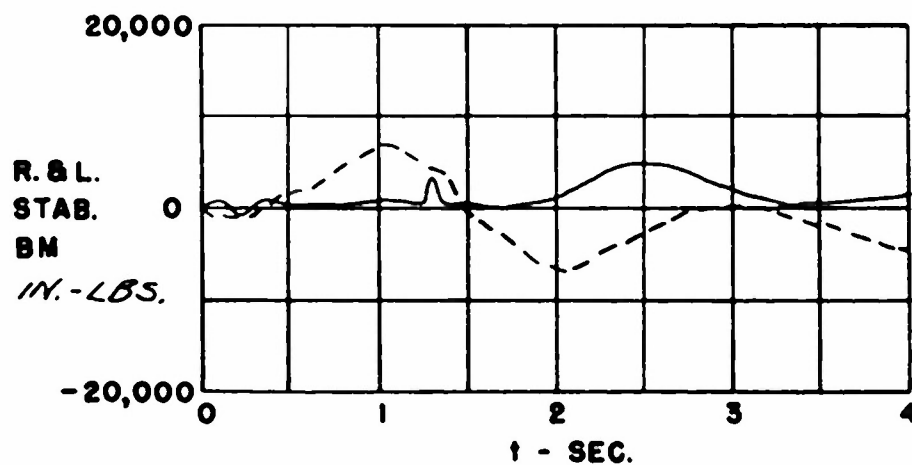
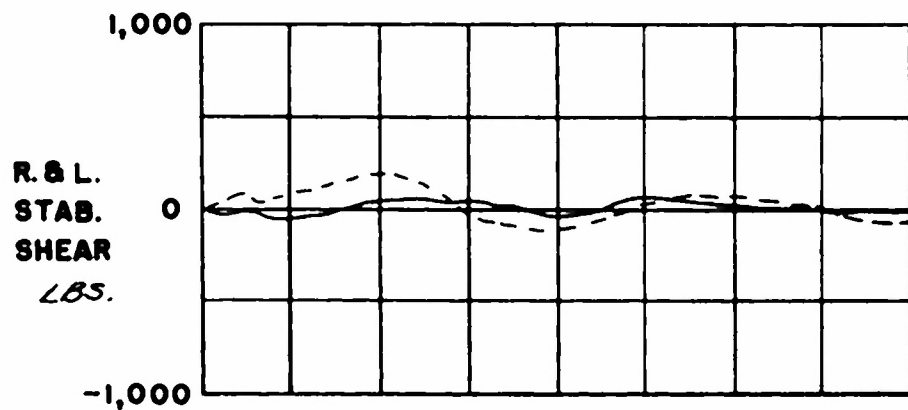
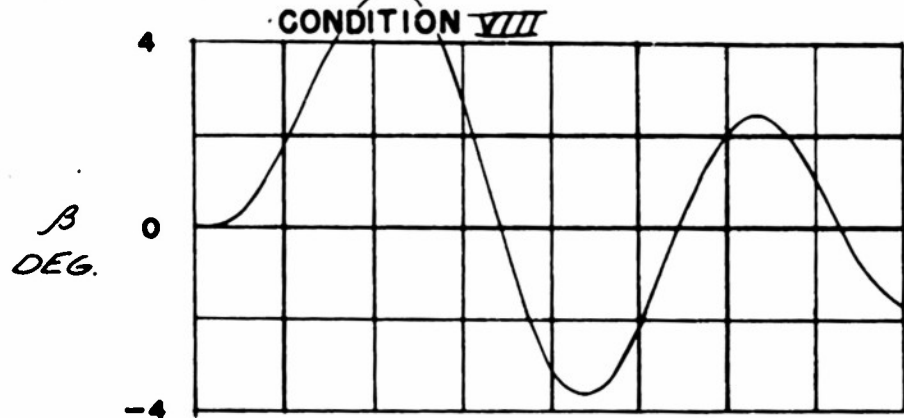


Figure 80

# F 80 A RUDDER KICK FLIGHT TESTS

MACH NUMBER .59

FLIGHT 37

RUDDER  $\delta_R$  5°

RUN 9689

KICK DURATION  $T_1$  1.2 SEC.

TIP TANKS OFF

TIME TO APPLY  $\Delta T_1$  .2 SEC.

ALTITUDE 20,195 FT.

TIME TO RETURN  $\Delta T_2$  .2 SEC.

O.A.T. -11.1 °C

AILERON MOVED ANTI ROLL  $V_0$  303 MPH.

CONDITION VIII

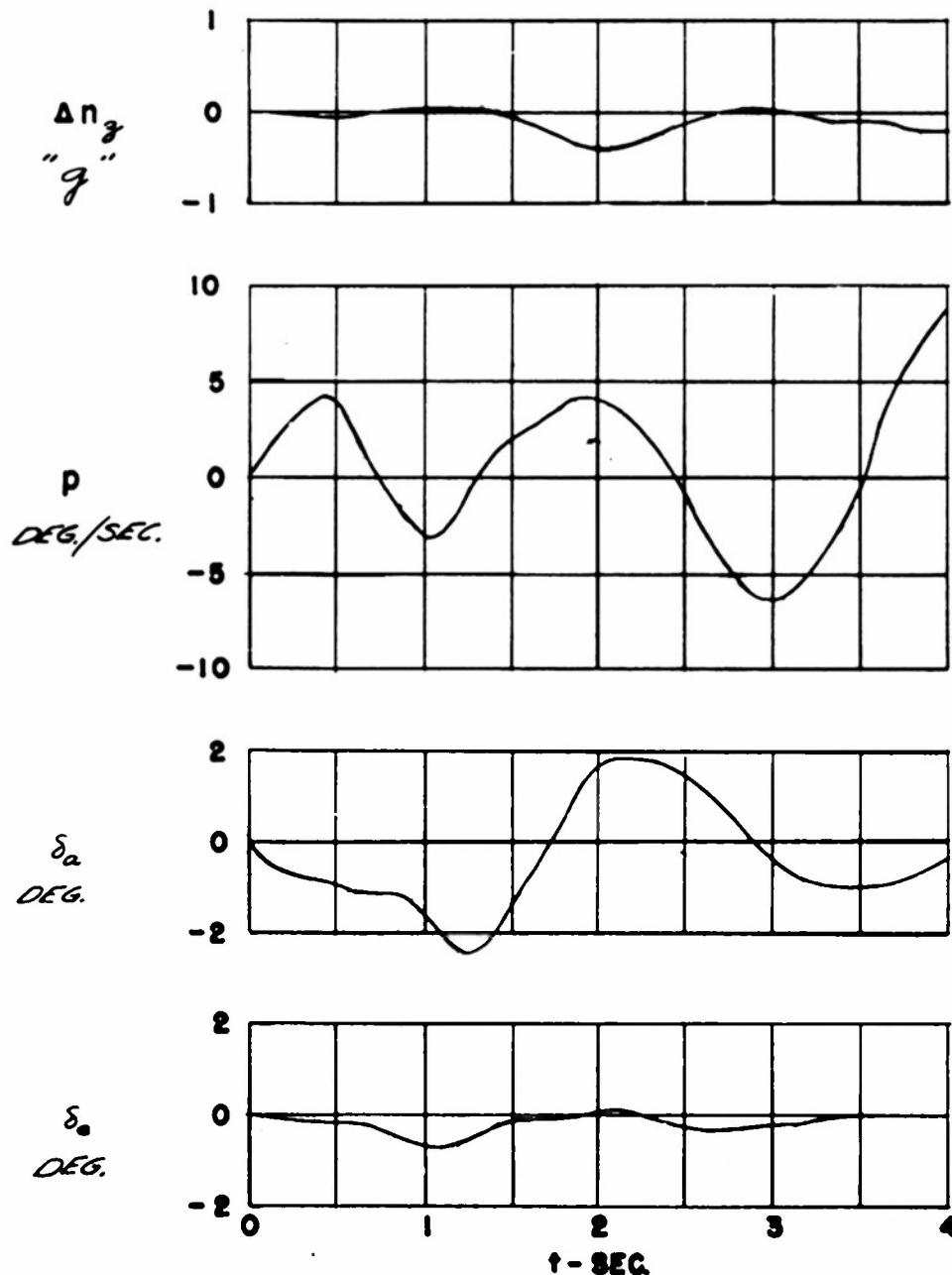


Figure 81

# F - 80A STEADY SIDESLIP FLIGHT TESTS

MACH NUMBER .398

FLIGHTS 36 & 37

ALTITUDE 20225 FT.

O.A.T. -10.8°C

V<sub>0</sub> 204.5 MPH

TIP TANKS OFF

CONDITION IX

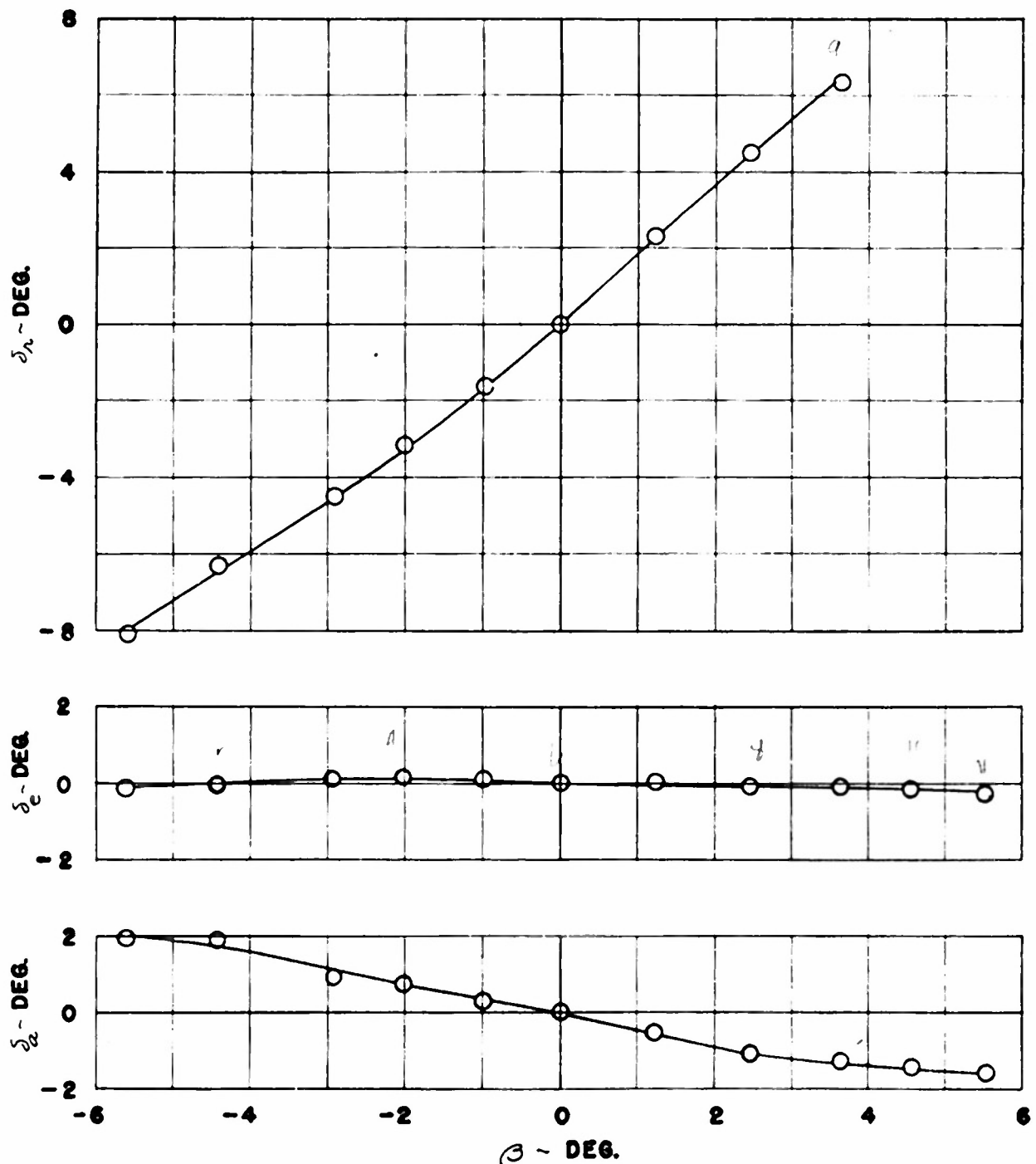


Figure 82

# F-80A STEADY SIDESLIP FLIGHT TESTS

MACH NUMBER .398

FLIGHTS 36 & 37

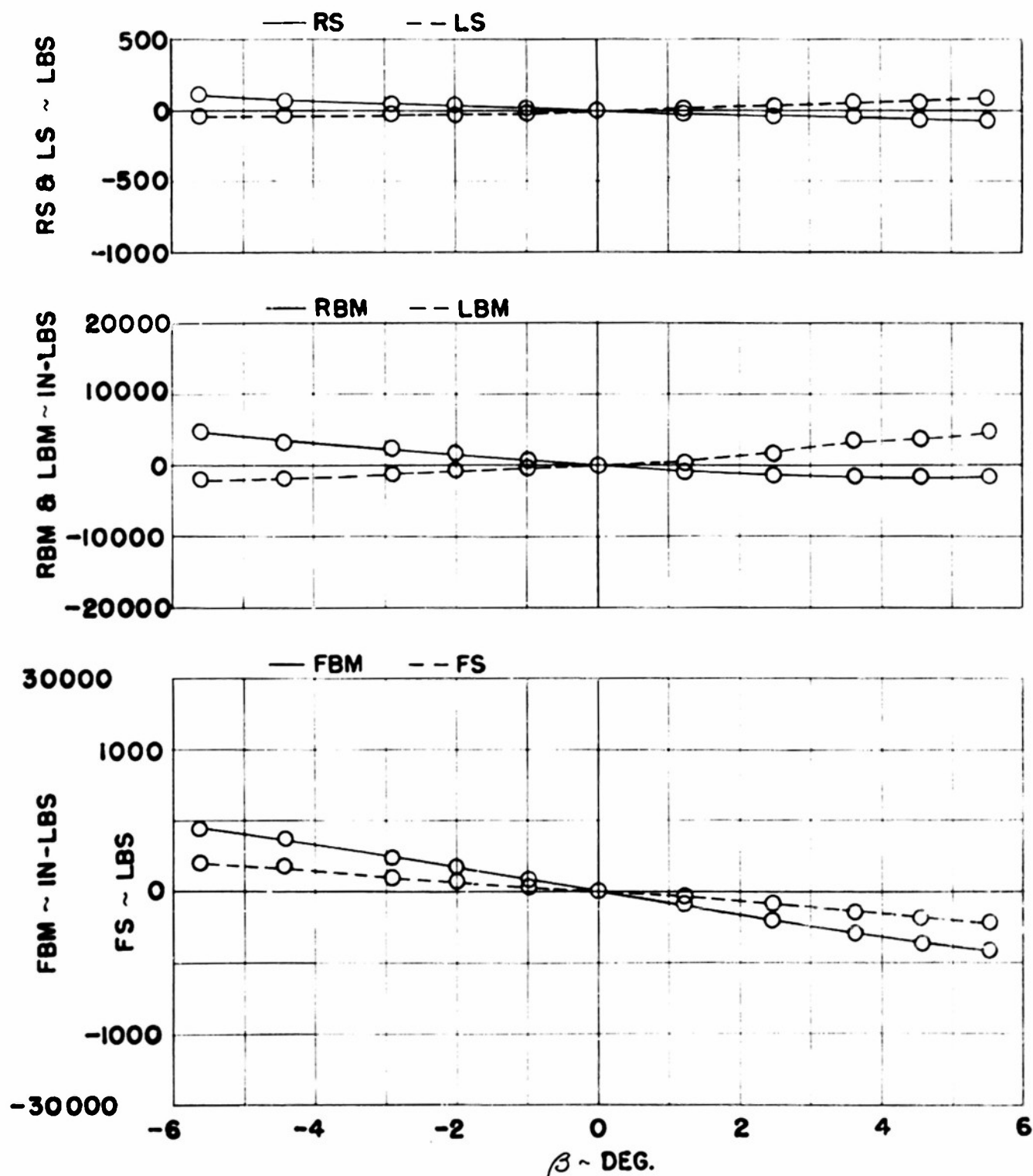
ALTITUDE 20225 FT.

O.A.T.  $-10.8^{\circ}\text{C}$ .

$V_e$  204.5 MPH

TIP TANKS OFF

CONDITION IX



$\beta$  ~ DEG.

Figure 83

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# F-80 A STEADY SIDESLIP FLIGHT TESTS

MACH NUMBER .588

FLIGHTS 36,37, & 38

ALTITUDE 20105 FT.

O.A.T. -11.4°C

$V_e$  302.5 MPH

CONDITION X

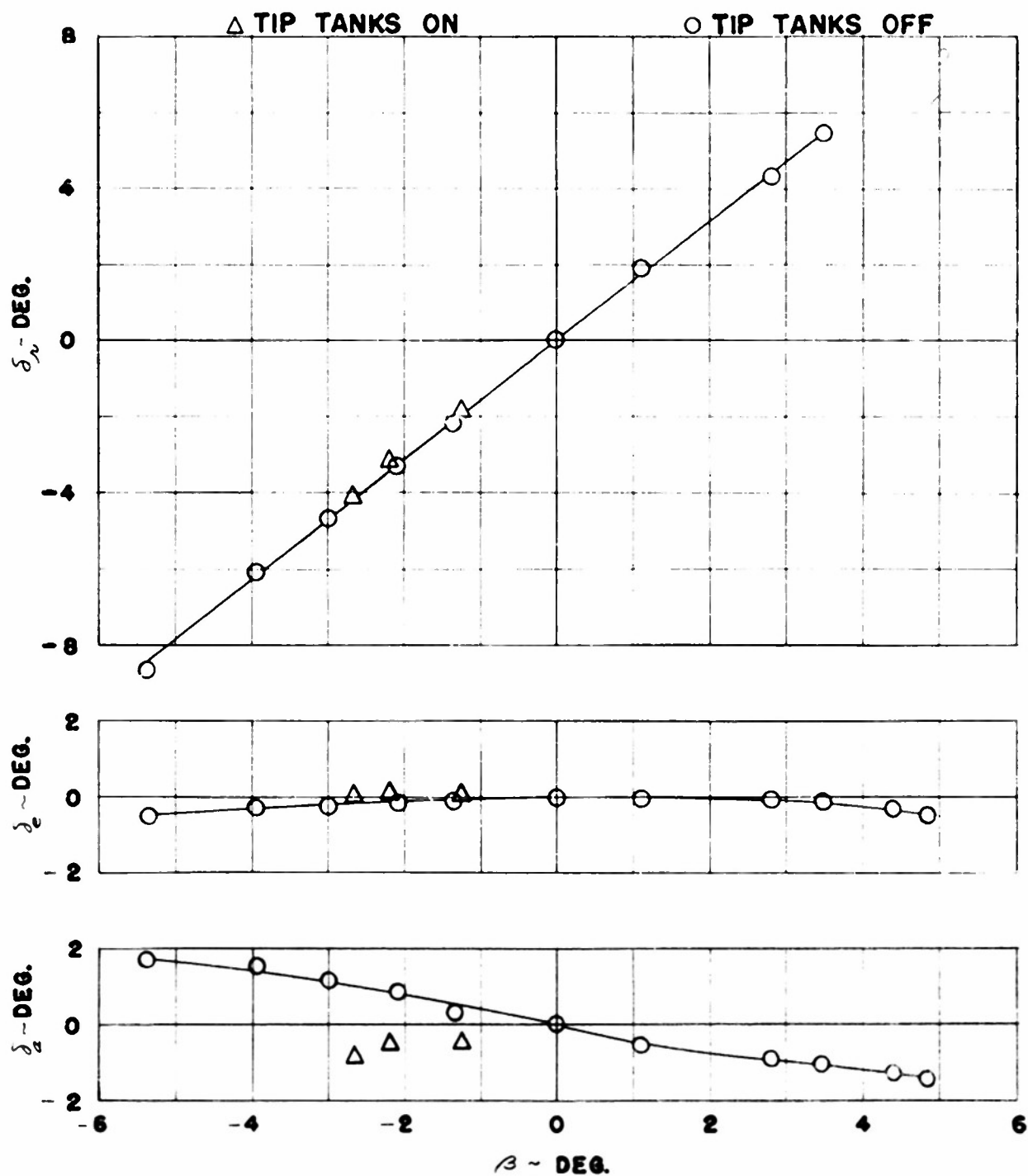


Figure 8h

# F-80A STEADY SIDESLIP FLIGHT TESTS

MACH NUMBER .588

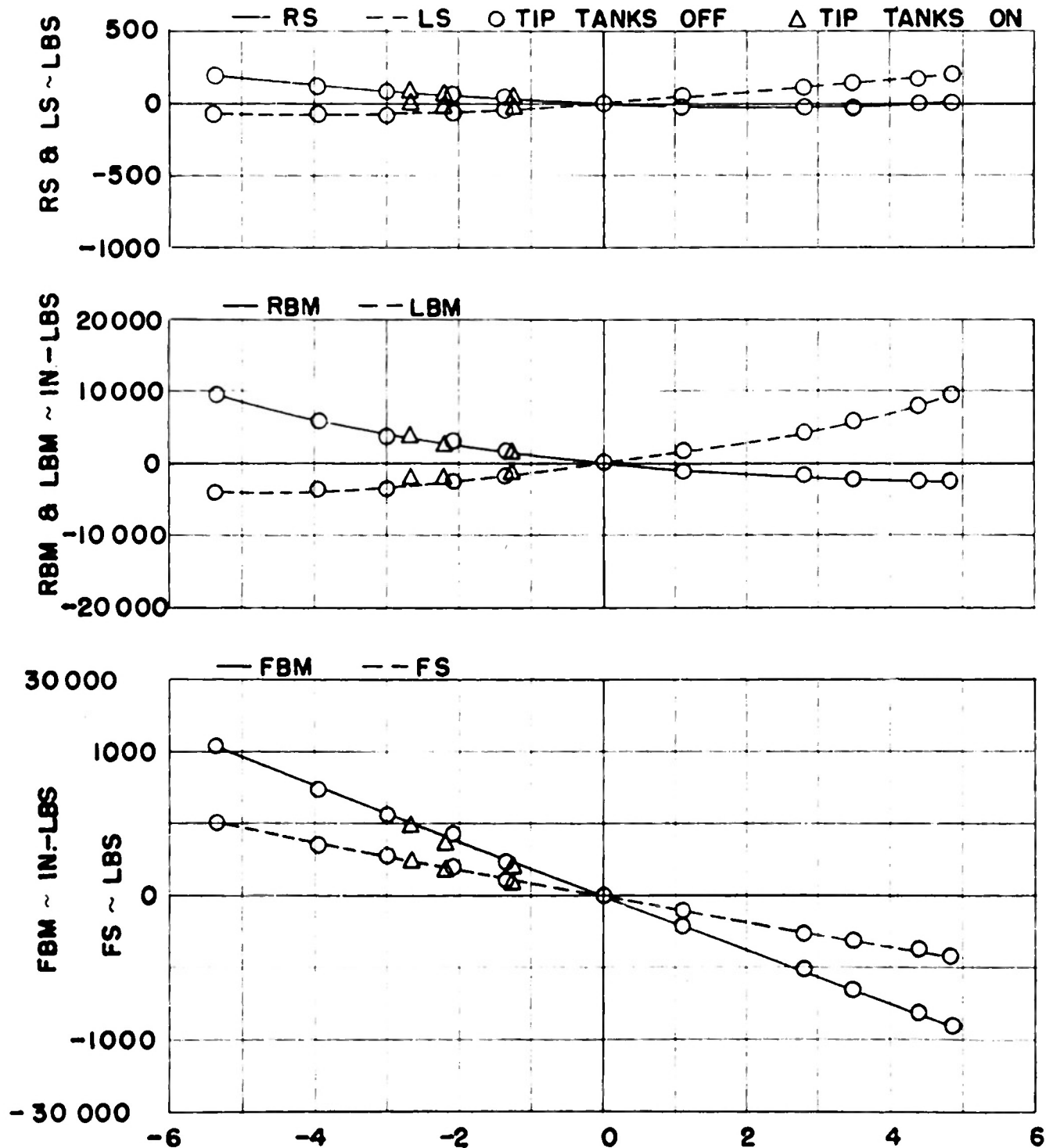
FLIGHTS 36, 37 & 38

ALTITUDE 20105 FT

O.A.T. -11.4°C.

$V_e$  302.5 MPH

CONDITION  $\Sigma$



$\beta \sim \text{DEG.}$

Figure 35

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# F-80A STEADY SIDESLIP FLIGHT TESTS

MACH NUMBER .687

FLIGHTS 36 & 37

ALTITUDE 20075 FT.

O.A.T. -10.8°C

$V_e$  353.5 MPH

TIP TANKS OFF

CONDITION XI

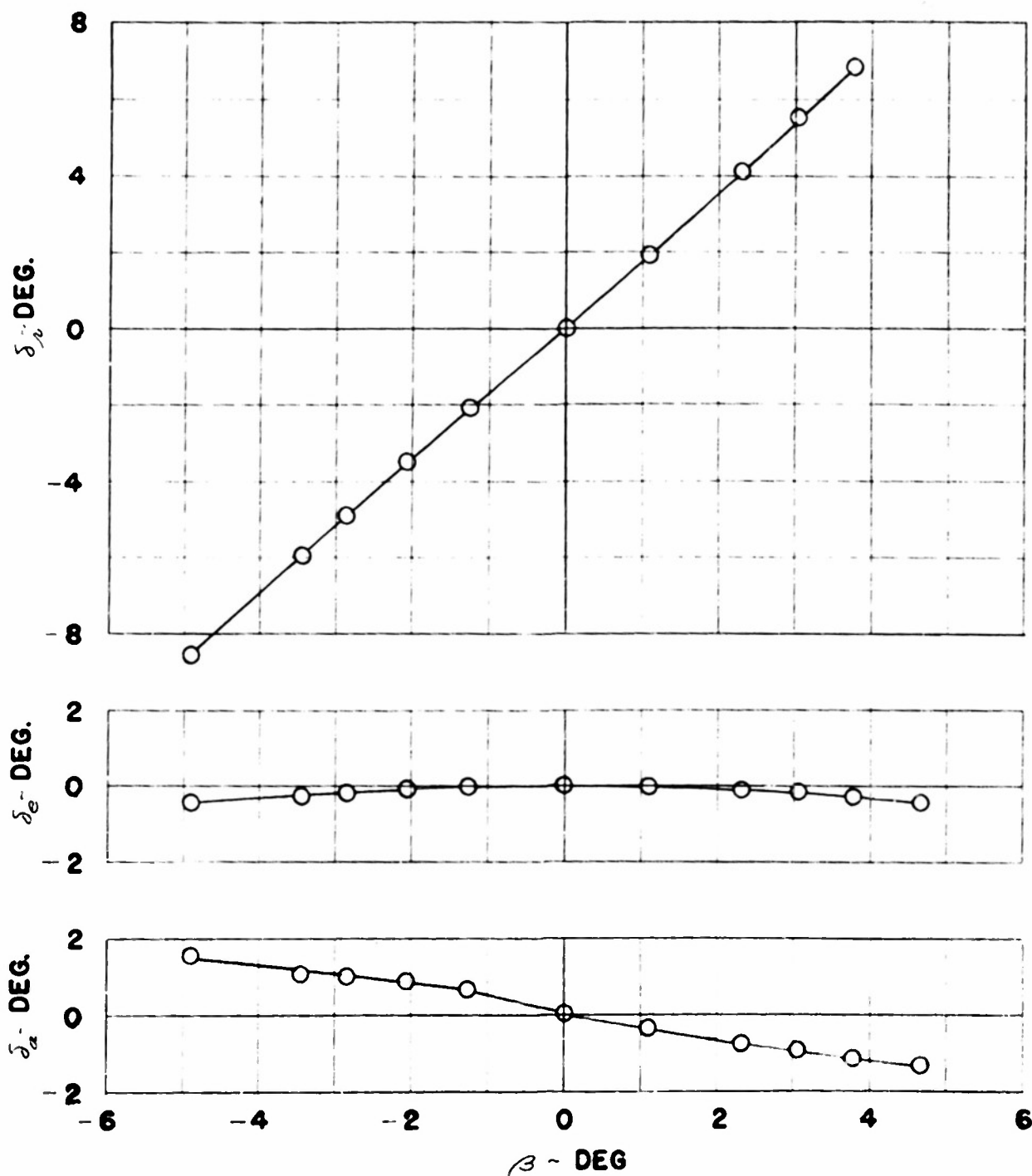


Figure 86

# F-80A STEADY SIDESLIP FLIGHT TESTS

MACH NUMBER .687

FLIGHTS 36 & 37

ALTITUDE 20075 FT.

O.A.T. -10.8°C.

$V_e$  353.5 MPH

TIP TANKS OFF

CONDITION XI

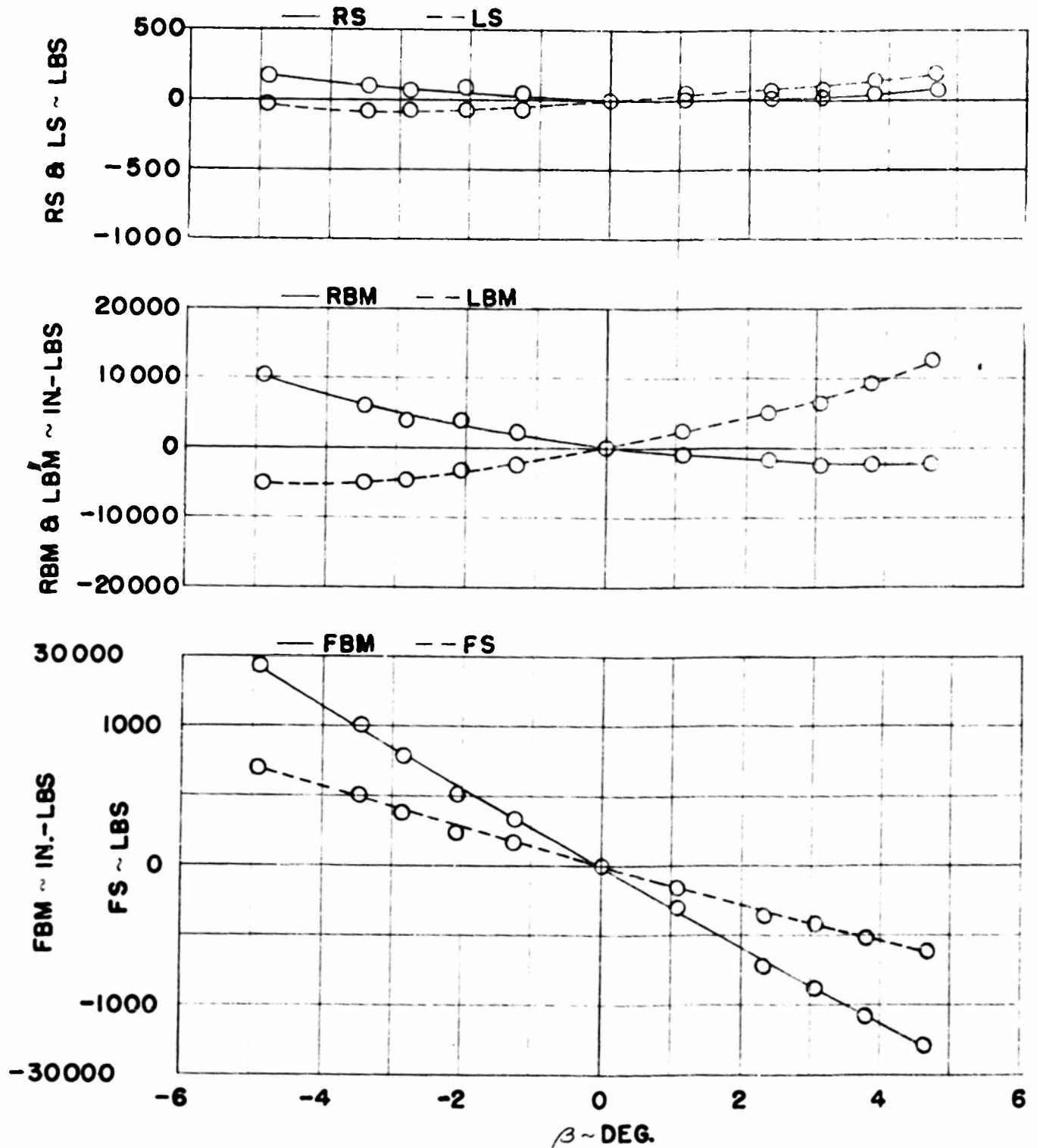


Figure 87

AFTR-6743